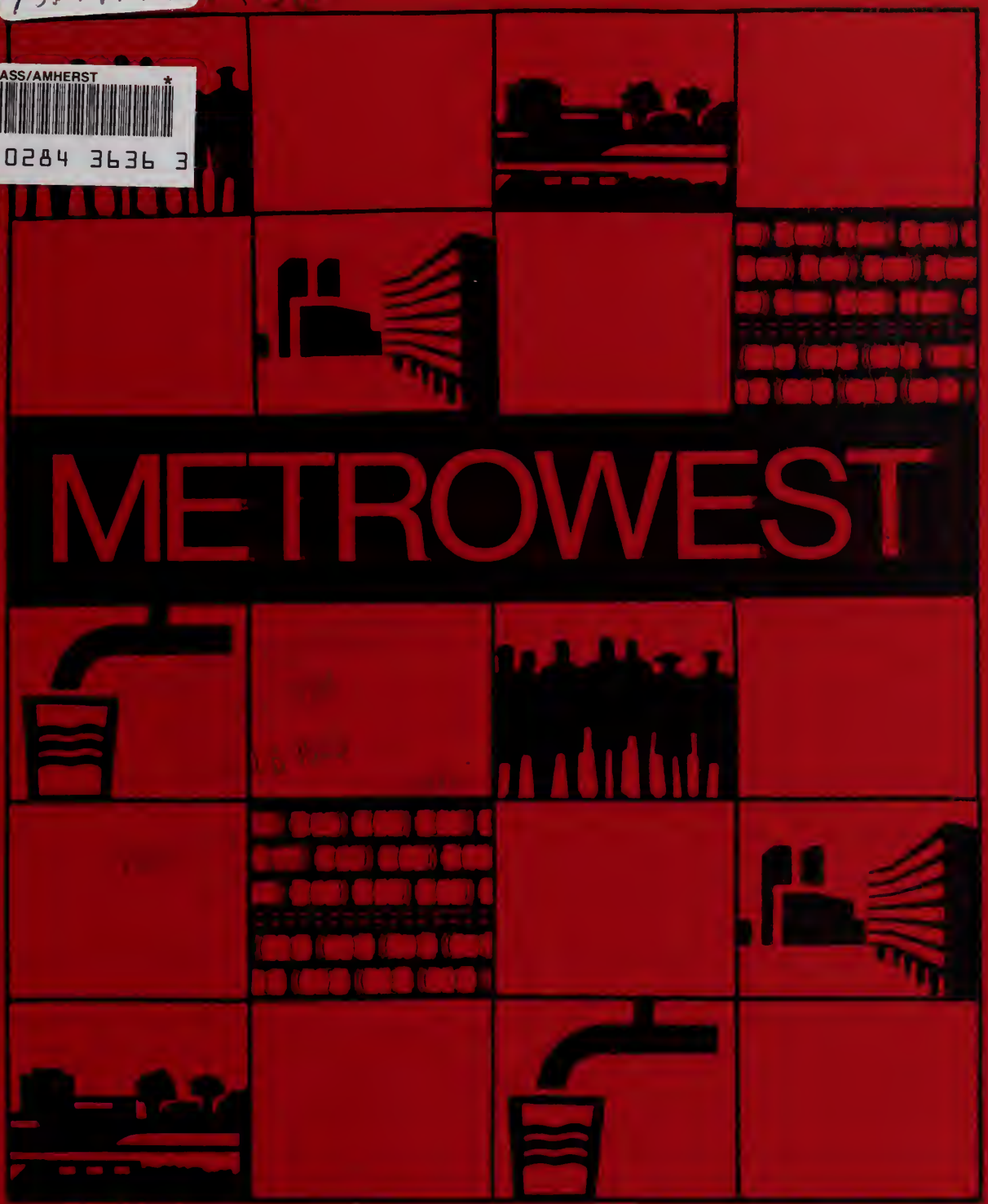

METROWEST

ASHLAND
FRAMINGHAM
NATICK
SOUTHBOROUGH
SUDBURY
WAYLAND
WELLESLEY
WESTON

GROWTH IMPACTS STUDY

Metropolitan Area Planning Council

"PLANNING"

"If we could first know where we are and whither we are tending, we could better judge what to do, and how to do it"

A. Lincoln

METROWEST

GROWTH IMPACTS STUDY

Final Report November 1984

The MetroWest Growth Impacts Study report was prepared by the Metropolitan Area Planning Council for the communities of Ashland, Framingham, Natick, Southborough, Sudbury, Wayland, Wellesley and Weston. The Metropolitan Area Planning Council is the officially designated regional-planning agency for 101 cities and towns in the Boston metropolitan area. The Council helps its member communities plan in the areas of land use, environmental quality, solid waste, hazardous materials, air quality, housing, economic development, and transportation.

The preparation of this document was assisted financially by the cities and towns of the MAPC region, the towns of Ashland, Framingham, Natick, Southborough, Sudbury, Wayland, Wellesley and Weston, and through grants from the Massachusetts Department of Public Works, and the federal Urban Mass Transit Administration.

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Transportation portions of this report were funded by Massachusetts Department of Public Works Grant 22946 and Urban Mass Transportation Administration Grant MA-09-0095, under Element IV, Task 10380, Plan Refinement of the FY 1984 Unified Planning Work Program.

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SUMMARY

The MetroWest region is in the midst of a development boom, with all the associated impacts, requiring strategies and decisions at the local level. While growth has had many positive effects on the region, the continuing increase in traffic, water use, wastewater, and solid waste generation will have adverse impacts on the communities, and will tax their ability to provide for the needs of residents.

Recognizing that most growth-related problems do not stop at town boundaries, the MetroWest communities decided to work together to study and address growth problems at a regional level. The MetroWest towns requested assistance from the Metropolitan Area Planning Council (MAPC), their regional planning agency, and a working committee of town representatives was formed to work with MAPC and to serve as liaison among the towns.

Anticipated Growth and Development

Forecasts of population and employment for the MetroWest region show moderate gains in population and strong gains in employment. Between 1980 and 1990 population is expected to grow by 2% (approximately 4,000 people), while employment will increase by 12% (approximately 11,000-12,000 employees).

Construction and development in the immediate future will add nearly 1,000 new residential units and over 6.2 million square feet of office, commercial, and hotel space.

Impact Analyses

Four impact analyses performed by MAPC examine the effects of growth on MetroWest's transportation, water supply, wastewater, and solid waste disposal systems--including the growth impacts and alternative methods of handling them.

Transportation

The transportation analysis, performed by the Central Transportation Planning Staff (CTPS), indicates that current conditions on Routes 9 and 30 are poor. Conditions on the region's other major routes, such as Routes 135, 126 and 27, are also poor. With the exception of Route I-90 (Massachusetts Turnpike), current levels of service throughout the region are at level E/F or worse. Conditions on MetroWest's arterial roadways during peak hours are worse than level E.

Traffic volumes will grow 7 to 15% by 1990. Traffic on east/west routes will grow by 10-11%, while traffic on the north/south routes will grow between 14 and 20%.

Further traffic increases will make highway travel conditions intolerable by 1990 unless measures are taken now to increase highway capacity and direct new growth to less congested areas.

Alternatives available to deal with traffic problems include:

- Route 9 and Route 30 widening
- Complete separation of Routes 9 and 30,
- Grade separated interchanges
- Improvements to north/south roadways
- Traffic management and control measures
- Land use controls (growth management)

Water Supply

In general, the MetroWest region appears to have adequate water supplies to serve the expected growth. However, adequate water supply is not the only concern. The reliance of many of the communities on groundwater makes its protection critical, including preservation of recharge for replenishing local supplies, and limiting the exportation of water. Framingham, Natick, Wellesley, and Weston already face contamination of local supplies. Ashland, Natick, and Wellesley face the potential of exporting an additional 500,000-750,000 gallons per day.

Several alternatives are available to communities to protect groundwater. They include zoning, subdivision regulations, board of health regulations, wetlands restrictions, and local public works policies. Local programs of water conservation, land acquisition, and conservation restrictions may also serve to protect water resources. Techniques for drainage improvements and the storage and treatment of stormwater may also help protect groundwater and/or enhance recharge systems.

Wastewater Disposal

Focusing primarily on the MDC sewer system which serves Ashland, Framingham, Natick, and Wellesley, MAPC's analysis indicates that new development will generate an additional average flow of .98 mgd over the current 12.2 mgd average flow, an 8% increase. The current sewer has the capacity to handle average flows, but cannot handle peak flows. Peak flow is expected to increase 2.5 mgd, also an 8% increase. Current problems with overflows and flooding will also get worse due to capacity problems during peak flows, both in the FES and the downstream Wellesley Extension and Extension Relief Sewers (WES/WERS).

The most immediate issue facing the affected communities is that of reducing peak period flows so as to reduce the incidence of overflows. A long-range structural solution is also needed. The MDC is currently engaged in planning and design for the replacement of portions of the WES/WERS line and construction of a new Framingham Extension Relief Sewer.

The alternatives available for reducing peak flows include:

- Continued infiltration/inflow reduction programs
- Use of flow equalization devices
- Water conservation programs

Solid Waste

Solid waste disposal practices in the MetroWest region are reaching the limits of their capacity to serve the current population and expected growth. Stringent regulations for the disposal of solid wastes in sanitary landfills make it necessary to find long-term solutions even where a landfill has a few more years capacity left.

Although the projected increase in solid waste generation is a modest 2% (an additional 2,156 tons per year in 1990), community disposal capabilities are limited and diminishing.

In the long term, alternatives to individual landfills must be developed since the supply of usable land is already scarce. The communities of MetroWest must use available techniques to reduce the volumes of waste produced, share landfill and incinerator capabililties, and pursue resource recovery options when available.

Recommendations

In addition to alternative actions available to alleviate particular impacts, MAPC and CTPS recommend that all towns should:

1. Form a permanent growth committee comprising a selectman from each MetroWest town to promote coordinated growth management, pursue comprehensive improvements to the region's infrastructure, and review and comment on significant development proposed for the MetroWest region.

2. Utilize regionwide growth management and resource protection techniques to allow towns to protect groundwater; require wastewater disposal methods which reduce peak flows; and develop access, traffic, and parking requirements which reduce traffic generation.

3. Develop intercommunity agreements for the treatment and disposal of solid waste.

More detailed MAPC/CTPS recommendations for each issue area follow.

Intercommunity Coordination

MAPC recommends the creation of a MetroWest Growth Committee whose duties would include: the development and promotion of coordinated growth management techniques for the region; coordination of regional efforts to pursue physical improvements for the region's transportation and sewer systems; development and promotion of coordinated resource protection measures and strategies; and review and advisory comment on major development within member towns. Such a committee could be created through an intercommunity Memorandum of Understanding (MOU). Membership should include one member of the Board of Selectmen from each town.

Transportation

The following are recommended:

1. Direct capacity additions to E-W roadways through widening, grade separation, and intersection improvements.

2. Intersection improvements to the N-S roadways.

3. Some form of growth management (land use controls) for the area.

The nature of this analysis did not allow detailed description of specific design improvements or combinations of improvements, but several recommendations can be made, including:

- Routes 9 and 30 warrant a detailed corridor planning study from Route 128 to Route 495. North-south travel in the corridor should also be examined.

- Towns should consider instituting some control on growth, directing it away from areas where traffic cannot be accommodated.

- Ridesharing, flexible or staggered work hours, and transit usage should be encouraged.

- Existing and new developers should participate in the financing of transportation systems improvements according to their contribution to traffic impact. Participation should also take the form of setting aside rights-of-way for improvements.

Water Supply

MAPC recommends that all MetroWest communities apply techniques to protect their groundwater. The need to protect, and the benefit from protecting groundwater, are well documented. The various techniques either create local authority, or draw on established regulatory powers, which allow towns to control development in watersheds and recharge areas and to influence drainage methods and sites.

Wastewater Disposal

The Council recommends that all MetroWest communities reduce the volumes of wastewater produced and, especially, the peak volumes of wastewater disposed of through the sewer systems. Local regulatory authority should be used to require alternative disposal methods and/or flow equalization techniques, such as holding tanks, and water conservation methods which reduce wastewater generation.

Solid Waste

MAPC recommends that the MetroWest communities reduce the volumes of solid waste requiring landfilling by encouraging recycling (such as curbside pickup in the larger communities of Natick and Framingham). Cooperative arrangements among communities will also allow the region's landfills to last longer. For example, excess incinerator capacity in Framingham should be used to reduce the volume of waste with residue to be disposed of in other landfills.

Growth Management/Resource Protection Techniques

A variety of techniques and regulations are available to communities to manage growth and its impacts and to protect natural resources. Depending on the methods used, a town can control the use, intensity, location, and impacts associated with new development. It is crucial for all MetroWest towns to develop and implement growth management measures.

MAPC recommends site plan review as a measure available to communities to manage the impacts of growth. As important as a strongly written bylaw is a knowledgeable and committed special permit granting authority to apply site plan review provisions. Coupled with town policies and departmental regulations, site plan review will provide the authority to review and guide growth to enjoy its benefits, and to limit the adverse impacts.

Site plan review allows control over the impacts of development already permitted under current zoning. In order to manage the overall development of the MetroWest region, broader techniques must be developed, such as zoning requirements which allow development on the basis of its impacts (i.e. water consumption, traffic generation). Techniques of this type should be based on detailed assessments of local resources and capacities.

A regional development plan for MetroWest which outlines the locations and type of development desired in the region, and the local resources expected to support that development, would provide long-term guidance for future development and management.

MAPC recommends the permanent growth management committee coordinate the development of a regional development plan and associated growth management measures. The Council will continue to provide technical assistance and guidance to the MetroWest communities--through its technical assistance programs and the joint committee to support continuing regional cooperation in the MetroWest region.

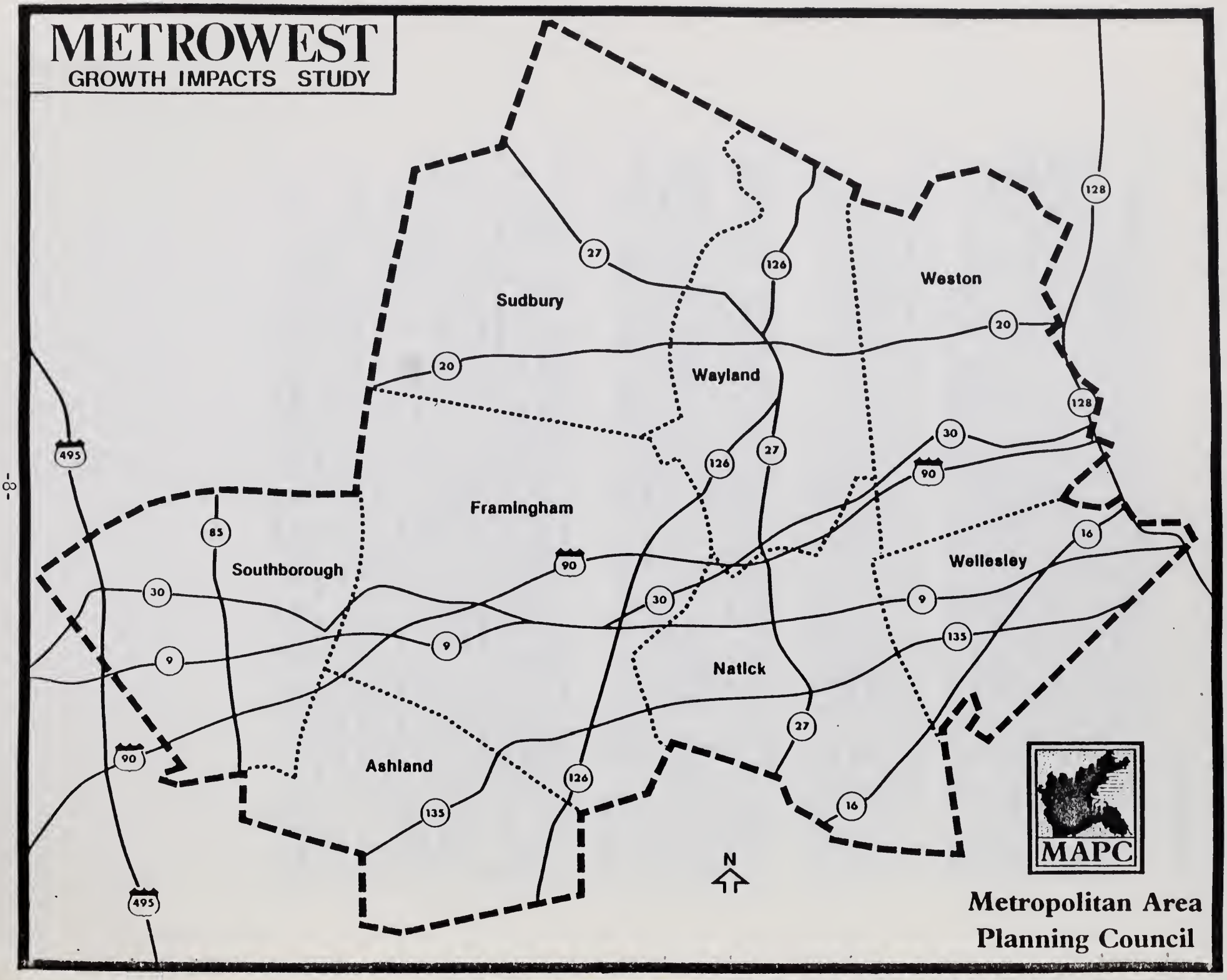
INTRODUCTION

At the local level, communities strive to attract new development, to gain benefits for the community and to control new development, lessening overall physical impacts. The location and intensity of such development is typically of greatest concern. Often overlooked, however, is how such development impacts are magnified when abutting communities pursue development independently. Communities often plan for the impacts associated with their own developments only to have their plans go awry because of complications from development in neighboring towns. Along commercial strips adverse development impacts appear to increase at a much greater rate than the development responsible for them.

If the public services necessary to support these developments are to be provided, an evaluation of the overall area must be undertaken to insure that the communities are aware of the cumulative effects. A multi-community assessment of growth impacts allows communities to understand the ramifications of the development and to plan strategies for maintaining their qualities of life.

Thirty years of development along Routes 9 and 30 near Speen Street and Route 126 have transformed Framingham, Natick and their surrounding communities into what is now known locally as "MetroWest." This development has had far-reaching effects on the transportation, business and development patterns of the area. The announcement of the expansion of the Shopper's World complex in Framingham and the realization that significant retail and office space construction was underway or planned in various locations along Route 9, led to renewed concern about the future of the area.

The MetroWest region, in the midst of a development boom with all its associated impacts, requires strategies and decisions at the local level. MetroWest is the name given to the eight communities forming a contiguous region along the Interstate 90 corridor between Routes 128 and 495. It includes the communities of Ashland, Framingham, Natick, Southborough, Sudbury, Wayland, Wellesley, and Weston (Figure 1). The region's proximity to Boston and Worcester, its excellent transportation network, and its country living appeal have resulted in attracting residents, businesses, and industries to the region. The communities have a rural to suburban character, despite their accessibility to Boston via the highway system which converges in the region. Although growth has had many positive effects on the region, the continuing increases in traffic, water use, and wastewater and solid waste generation will have adverse impacts on the communities and will tax their ability to provide for the needs of their residents.


METROWEST
GROWTH IMPACTS STUDY
Sudbury
Weston
Wayland
Framingham
Southborough
Wellesley
Natick
Ashland
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MAPC
Metropolitan Area
Planning Council

Recognizing that most growth-related problems do not stop at town boundaries, MetroWest communities concluded that the problems and opportunities connected with the effects of development should be studied on a regional basis and could best be dealt with by several communities working together, even though each town's authority to act must be exercised separately. Representatives of the MetroWest towns agreed to request assistance from the Metropolitan Area Planning Council (MAPC) to study and seek solutions to growth connected problems, including but not limited to traffic. They also agreed to form a "Working Committee" of town representatives to guide MAPC's efforts and to serve as liaison to the selectmen and other boards in their respective towns.

This report documents the work performed for the MetroWest Working Committee by MAPC and the Central Transportation Planning Staff (CTPS). Meeting periodically over the past year, MAPC, CTPS, and the Working Committee collected information, analyzed options, and developed recommendations for the individual communities and the MetroWest region.

The Study Area

The MetroWest communities share the problems associated with growth, though not all of the communities are faced with the same problems to the same extent. The following capsule descriptions provide some insight into the varying characteristics and concerns of the MetroWest communities.

Ashland has evolved from an industrial center to a residential suburb. It has never been a commercial center because of its close proximity to Framingham. This has resulted in current local concerns over the high volumes and congestion on Route 126 which is affecting access to and from Framingham.

Framingham functions as the heart of MetroWest with the transportation corridors responsible for its lifeblood. It is the economic center of the area with major commercial and industrial establishments diversifying its economic base. Its character is changing from that of an industrial town to a regional trade and service center. As such, its dependence on Boston, despite the proximity, will decrease as it becomes more diverse and capable of supporting a wider array of services. Development in Framingham has resulted in several concentrated areas of activity with individual problems and potential associated with each. This is reflected in local concerns over the intensive development occurring along Speen Street, Old Connecticut Path, Route 30 and Route 9.

Natick is primarily a residential town with some commercial and industrial development. Natick Center and the Route 9 corridor are important commercial areas with industrial development centered along major transportation corridors and in industrial parks. Local concerns are related to specific volume/congestion problems, wastewater disposal, protection of current water supplies and the development of future supplies, and future solid waste disposal capacity.

Southborough is predominantly a residential community interested in maintaining its current small town atmosphere. Although rural in character, its proximity to major population and employment centers is creating development pressures along the Route 9 corridor. Local concerns center on specific volume/congestion problems along Route 9.

Sudbury is still mostly rural, although commercial development is beginning to put a strain on the community. There is local concern over traffic volumes and congestion on Route 20, and routes affecting access to and from Framingham.

Wayland is primarily a residential community concerned with preserving its country-like image. Although there is commercial develo ment as well as a large electronics company in town, residents are opposed to further commercialization of the town. Local concerns are over the traffic volume and congestion problems along Route 30, and future solid waste disposal capacity.

Wellesley, although once exclusively a bedroom suburb of Boston, has grown into an employment center itself. Despite its growth, it is still a predominantly residential community striving to preserve and enhance this image while discouraging strip development along transportation corridors. Local concerns center on current sewer capacity problems in the southwestern part of town and future capacity given potential growth, commuter volumes and congestion problems on Route 9, and protection of current water supplies and development of future supplies.

Weston is a residential community in a rural setting only 12 miles west of Boston. Although business and industry is limited in the town, problems have arisen because of its proximity to Boston. There are local concerns over specific intersection problems on Route 30 due to commuter traffic. Other local concerns include the future solid waste disposal capacity of the town's landfill.

Individually the communities have attempted, in various ways, to accommodate growth and its impact. Frequently however, communities do not realize the scale at which growth is occurring in their own and surrounding communities. This report documents the growth expected to occur, the impacts on major municipal services, and recommended actions for individual communities and the MetroWest region as a whole.

A regionwide analysis of the impacts of growth provides the affected communities with strategies for managing growth, improving municipal service systems, and enhancing the value of the development that occurs. As the first step in what must be a continuing program for MetroWest, the report analyzes the impacts of a growth on the current transportation, water supply, sewer and solid waste disposal systems, and provides recommendations for local action and regionwide strategies for growth management.

ANTICIPATED GROWTH AND DEVELOPMENT

Community concern regarding the development of the MetroWest region is the basis for MAPC's growth impacts analysis. Trends in population, employment levels and construction activity will affect future conditions in each community and in the region as a whole. Essential to an assessment of the impacts of growth in these areas are forecasts of population and employment levels and an inventory of anticipated commercial and residential development. These forecasts are the foundation upon which the impact analyses are based.

Table 1 presents past and projected population and employment for MetroWest. Increases in population and employment are forecast through 1990. While the gains in population are expected to be modest (approximately 2% between 1980 and 1990), employment growth forecasts is expected to be much greater (approximately 12% between 1980 and 1990). By 1990, it is expected that employment levels in MetroWest will increase by 11,000 to 12,000 employees.

Table 2 is a composite of the proposed square footage for each type of development in the MetroWest communities. It reflects the permitted use of land and availability of land in each community. Total proposed development in MetroWest exceeds 6 million square feet, heavily concentrated in some parts of the region. Map 2 illustrates the location of the proposed developments within the region. This is again indicative of local efforts to establish or maintain a certain community image. It should be noted that the difference in employment figures from Table 1 is not an error. Employees represented in Table 2 are those associated with the proposed developments alone. Employment figures in Table 1 account for both overall employee gain and loss.

Appendix A provides a summary of new commercial construction and expansion projects, as well as that of major residential construction within the MetroWest region. The developments listed are those which are currently under construction or planned for completion within the 1980-1990 period. Development within MetroWest is characteristic of the local conditions within the communities themselves and the image each is trying to establish or maintain. These characteristics enhance the diversity of the region, and the diversity and scope of development. This is evident from the Table, which reveals a range from no major development proposals in Weston to 17 development proposals in Framingham. The type and magnitude of these developments provide insight as to how each community is growing, and what these changes will mean to the character of each community in terms of providing essential public services and retaining an image as an attractive place to live and work.

TABLE 1
MetroWest Population and Employment
1960 - 1990

	1960	1970	1980	1982[3]	1985	1990
Ashland						
Population[1]	7,779	8,882	9,165	-	10,100	11,100
Employment[2]		4,332	3,564	3,596	3,600	3,600
Framingham						
Population	44,526	64,048	65,113	-	65,100	65,100
Employment		26,393	40,136	39,031	43,300[4]	46,000[4]
Natick						
Population	28,831	31,057	29,461	-	29,500	29,500
Employment		16,688	15,562	16,100	16,500[4]	17,500[4]
Southborough						
Population	3,996	5,798	6,193	-	7,000	7,800
Employment		1,366	3,439	3,088	4,000	4,000
Sudbury						
Population	7,447	13,506	14,027	-	14,000	14,000
Employment		3,882	7,186	6,711	7,600	7,900
Wayland						
Population	10,444	13,461	12,170	-	12,200	12,200
Employment		4,826	2,948	2,796	3,200	3,400
Wellesley						
Population	26,071	28,051	27,209	-	27,200	27,200
Employment		8,896	16,117	15,774	17,000	17,500
Weston						
Population	8,261	10,870	11,169	-	11,200	11,200
Employment		2,148	3,147	2,991	3,400	3,600

Totals	1960	1970	1980	1982	1985	1990
Population	137,355	175,673	174,507	-	176,300	178,100
Employment	-	68,531	92,099	90,087	98,600	103,500

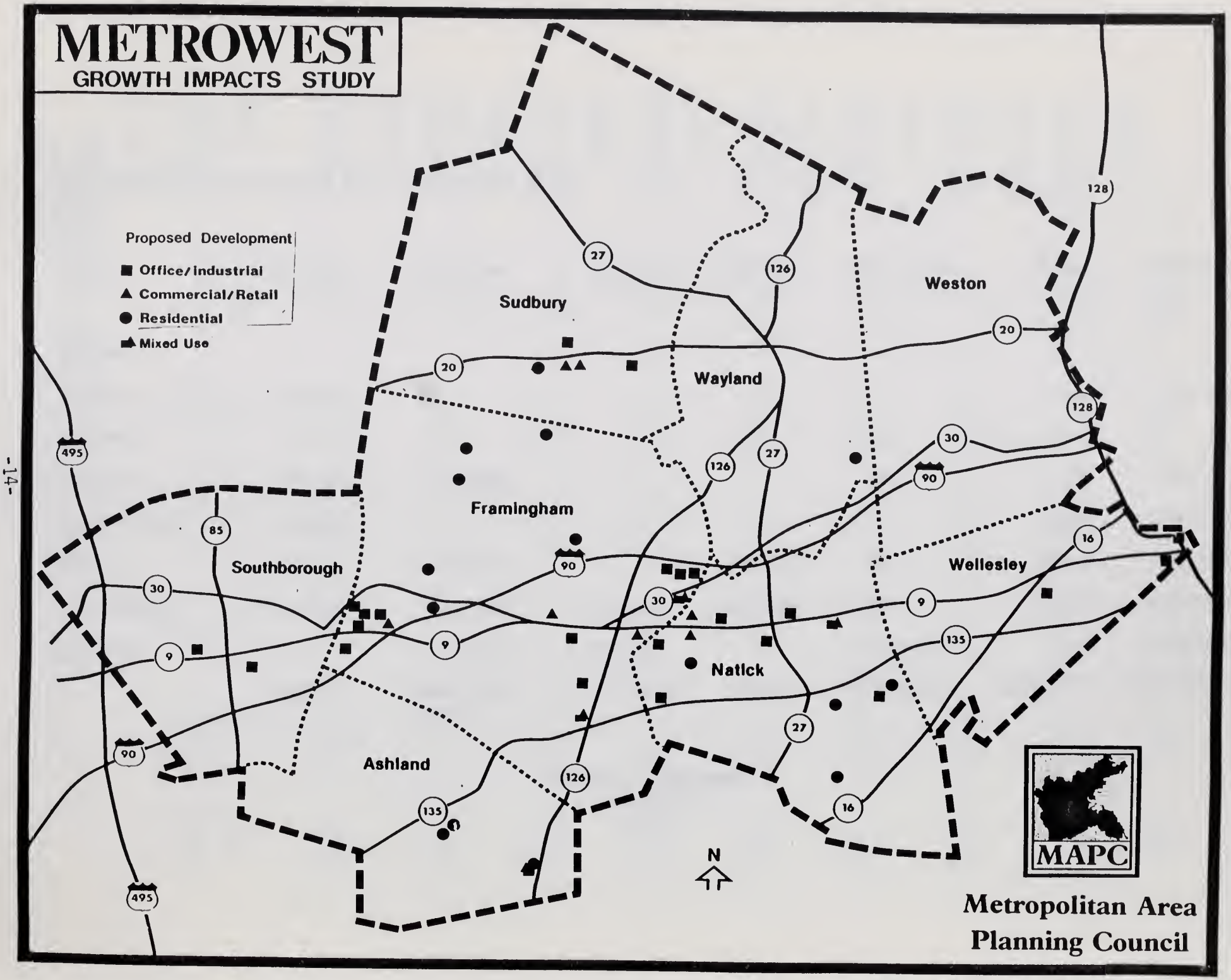
Sources:

1. MAPC Regional Decline or Revival, May 1982
2. MAPC Employment Location in Greater Boston: 1970-2010, July 1983
3. Massachusetts Division of Employment Security, August 1983
4. MAPC revised forecast, December 1983.

TABLE 2
METROWEST
PROPOSED DEVELOPMENT

	Office	Retail/ Commercial	Lt. Industrial	Hotel	Residential	Employees	Total Sq. Ft.
Ashland	-	250,000	200,000	-	984 units	700	450,000
Framingham	2,545,000	857,500	101,000	300,000	296	10,850	3,803,500
Natick	665,100	360,000	-	300,000	320	3,770	1,325,100
Southborough	312,000	-	-	-	-	1,250	312,000
Sudbury	61,500	103,000	-	-	140	460	164,500
Wayland	-	-	-	-	296	-	-
Wellesley	221,000	-	-	-	-	560	221,000
Weston	-	-	-	-	-	-	-
Totals	3,804,600	1,507,500	301,000	600,000	2,036 units	17,590	6,276,100

Metropolitan Area Planning Council, January 1984


METROWEST
GROWTH IMPACTS STUDY
Proposed Development
Office/Industrial
Commercial/Retail
Residential
Mixed Use
Sudbury
Weston
Wayland
Framingham
Southborough
Wellesley
Natick
Ashland
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TRAFFIC IMPACTS

The following is an assessment of the MetroWest growth impacts on travel. The analysis which follows should be regarded as a pilot study providing the communities with a framework for decisions on solutions to the traffic problems in the area. An evaluation at a detailed technical level would be a major undertaking for an area with the traffic complexity of MetroWest. No pertinent data is currently available to permit this type of analysis.

The following sections examine the existing transportation characteristics in the area, describe the traffic forecasts, and present the options available to the communities for improvements.

TRANSPORTATION CHARACTERISTICS

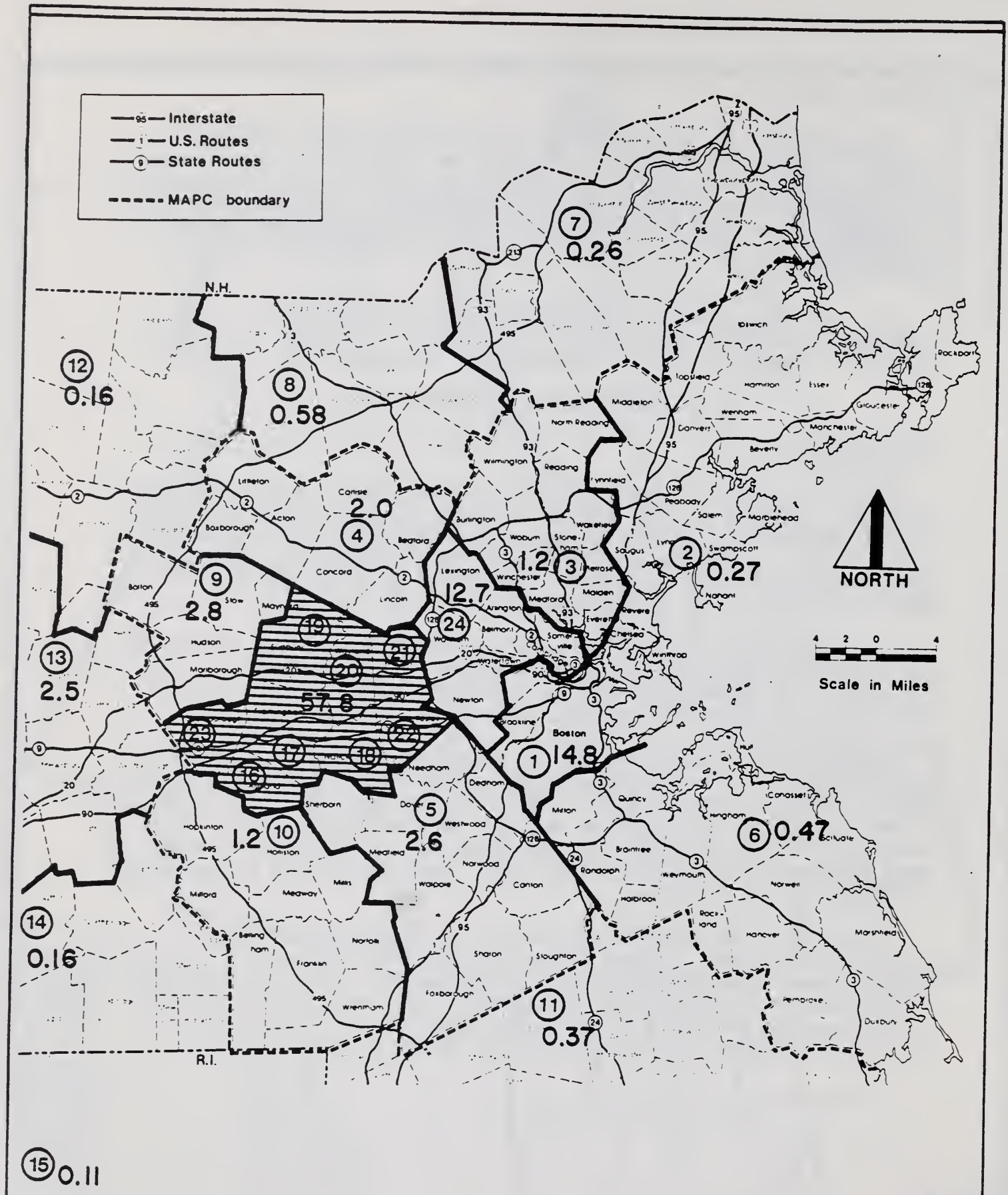
Travel Patterns

The U.S. Census is a readily available source of information on travel patterns. Starting in 1970, the U.S. Census collected data on the Journey to Work including origin and destination of the trip, length, means of travel to work, and automobile ownership. By examining these travel characteristics through tabulations, mapping or modeling, the travel behavior of workers can be determined.

To study travel patterns, the area under analysis and that immediately surrounding it must be divided into convenient traffic analysis districts. For MetroWest, there are 8 analysis zones within the study area and sixteen districts covering the rest of the state.

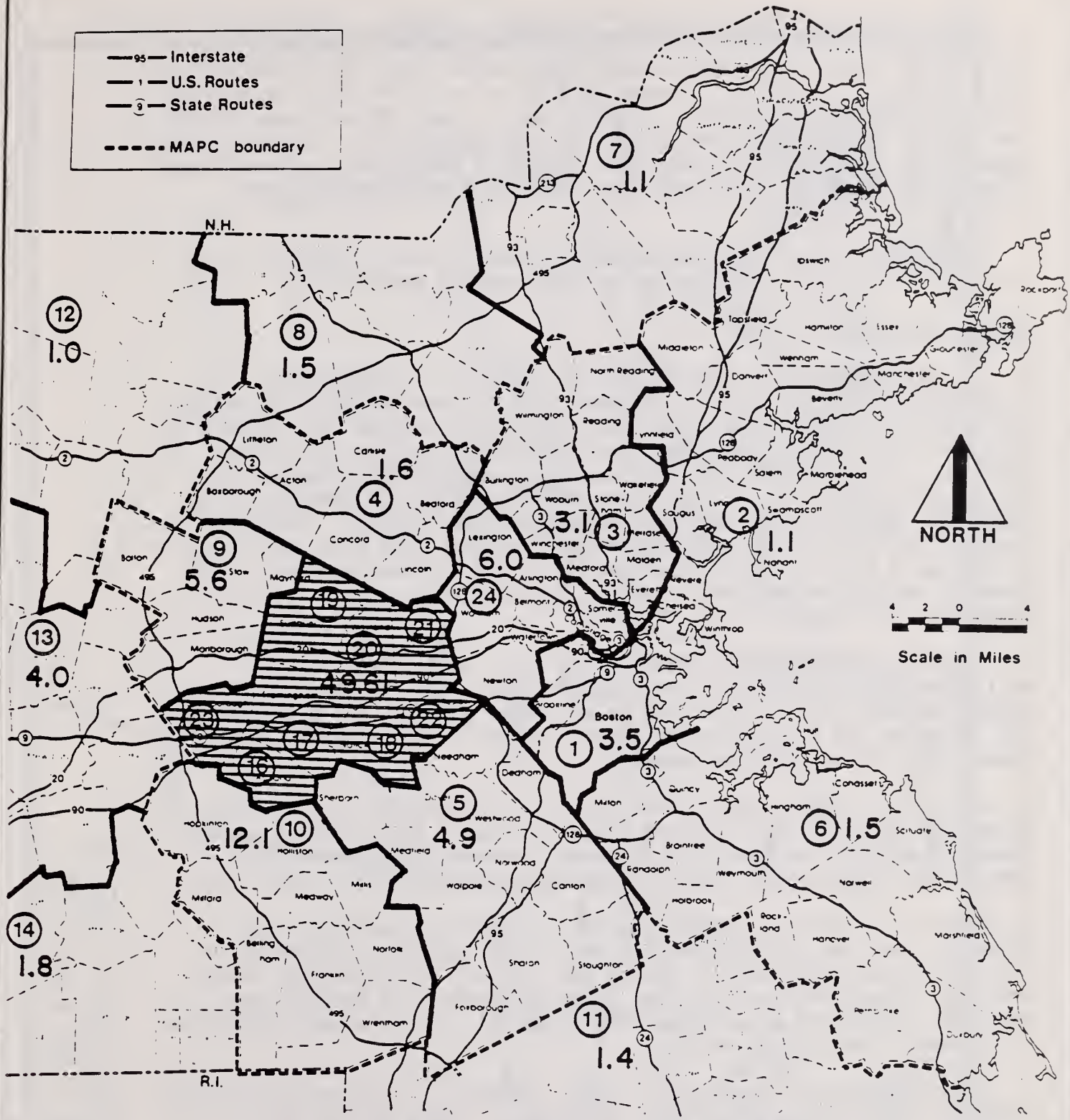
Figures 2.1.1 and 2.1.2 reveal the geographic distribution of the work trips leaving and entering the study area. Figure 2.1.1 illustrates that the majority of workers live and work within the MetroWest area (57.8%). Of the rest of the workers, more than half have destinations in communities within Route 128. The remaining work trips are distributed among the rest of the analysis districts. Their percentages diminish with distance from the study area.

Figure 2.1.2 exhibits the distribution of origins of all those employed in MetroWest. It can be seen that 49.6% of the workers originate from MetroWest communities. The rest of the workers come from communities to the south of the study area, between Route 495 and Route 128; to the west, along I-90 and Route 9; to the northwest, west of Route 495; and, finally, from communities within Route 128 to the east.



DISTRIBUTION OF WORK PLACES OF METRO-WEST RESIDENTS

FIGURE 2.1.1.



DISTRIBUTION OF ORIGINS OF METRO-WEST EMPLOYEES

FIGURE 2.1.2

Other useful classifications of trips are: external (leaving or entering the study area), inter-zonal (between MetroWest communities), intra-zonal (within MetroWest communities), and through (not stopping in the area) trips. Table 2.1.1 shows that more than half of all work trips have MetroWest as the origin or destination -- about 21% are made within the area by MetroWest residents, and 13% stay within their community boundaries. Finally, the least siginificant of the trips are through work trips which cross the area along the north-south or the east-west direction.

Information describing the means of travel to work, automobile use, trip duration, and traffic counts are contained in Appendix B.

Transportation Facilities

The transportation system of an area serves as its backbone. The quality of service it provides encourages or discourages mobility and, in turn, economic development. The location of MetroWest in that respect is unique. It lies entirely between circumferential Routes I-495 and 128/I-95. Interstate 90 runs east-west with three interchanges in the study area. Route 9 and Route 30 are almost parallel to I-90 and, with Route 135, form a highly developed transportation corridor. Route 16 provides mobility in the southwestern part of the study area, and Route 20 is available for the east-west movements in the northern communities of Sudbury, Wayland and Weston. Finally, Routes 85, 126, and 27 cross the study area north-south.

Interstate 90, 495, and 128/I-95 are fully controlled access facilities with 8, 6 and 6 lanes, respectively. Most of the longer-duration east-west through trips travel on I-90, while Routes 495 and 128 serve the north-south movement portion of trips, mostly from or to communities distant from MetroWest.

Route 9 is a four-lane divided, partially controlled access, urban arterial. Route 30 is a two-lane urban arterial. Both Routes 9 and 30 serve the majority of the local east-west movements for the southern communities of Wellesley, Natick, Framingham, Ashland and Southborough.

Route 20, a two-lane urban arterial, carries the east-west local movements and some of the through trips in the northern communities of Sudbudy, Wayland and Weston. Routes 135, 16, 27, 126, and Speen Street are also characterized as two-lane urban arterials. In Southborough, Route 85, classified as an urban minor arterial, serves as an alternative to the major north-south routes.

Finally, this basic network of major roadways is supplemented by many roadways classified as urban minor collectors. These collect or distribute traffic from or to the major arterials. Figure 2.3.1 shows the basic network described above. Figure 2.4.2 shows the Average Daily Traffic (ADT) for the network, for 1980.

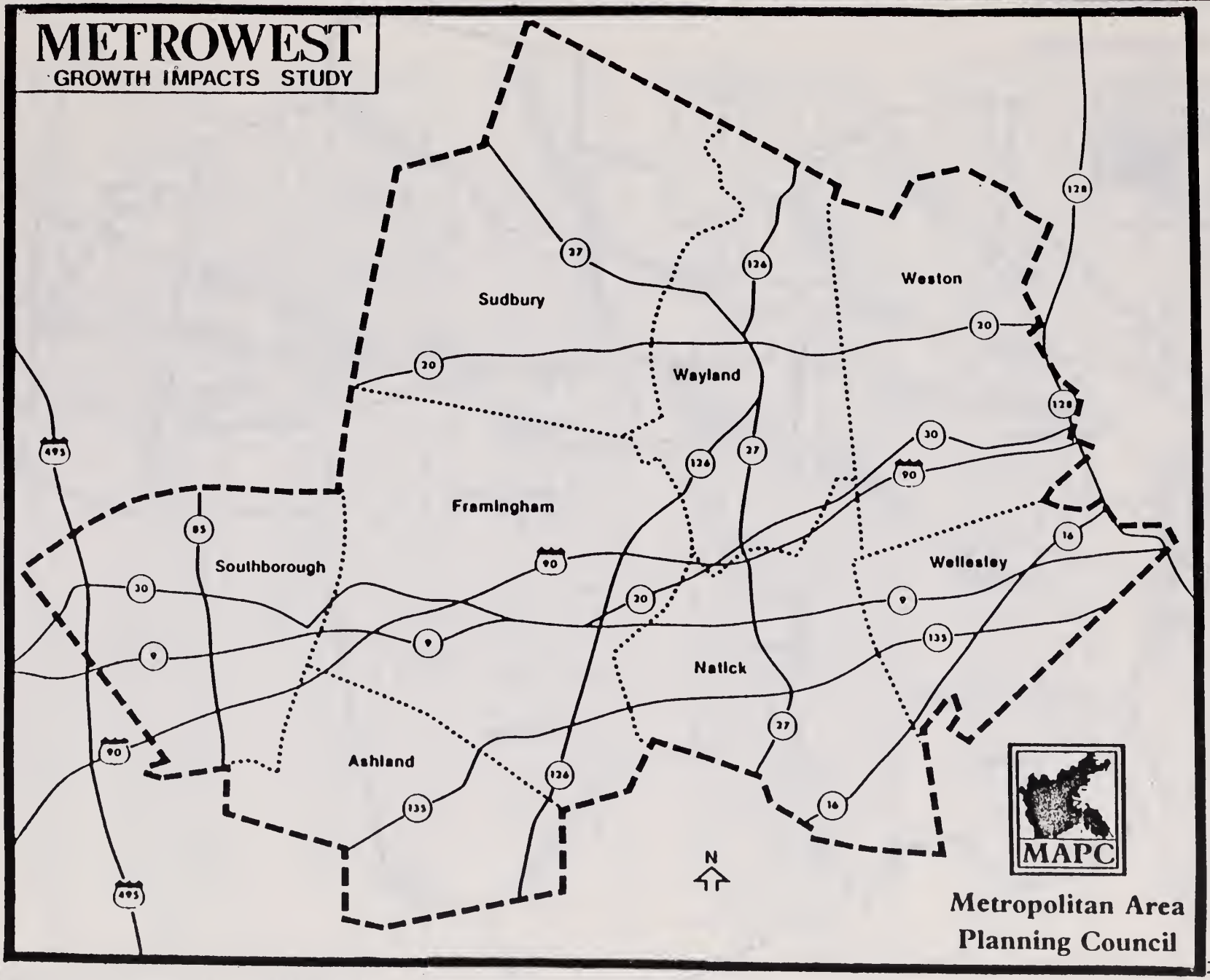
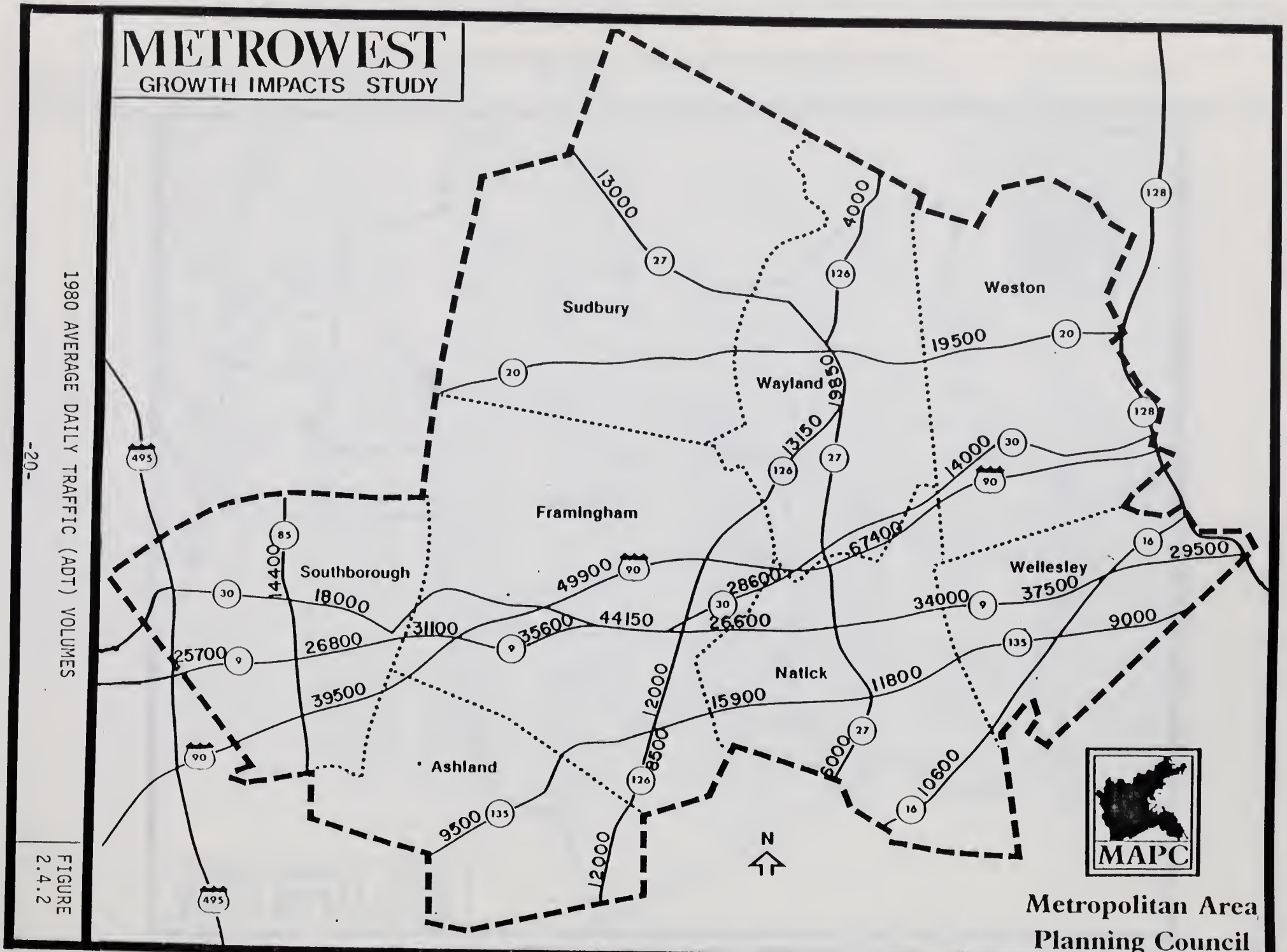


TABLE 2.3.1

MAJOR TRANSPORTATION FACILITIES IN METRO-WEST



1980 AVERAGE DAILY TRAFFIC (ADT) VOLUMES

FIGURE
2.4.2

Existing Level of Service

Level of service is a measure of the quality of the traffic flow on a facility or intersection. The index ranges from A to F with Level of Service (LOS) "F" indicating a breakdown of the facility's ability to handle the traffic volumes.

Usually, the operation of a roadway at a Level of Service "C"/"D" is considered satisfactory. The determination of the Level of Service implies a comparison between demand and supply; in other words, between volume and available capacity. The capacity of the facility is primarily a function of the roadway width, mix of traffic, type of traffic control, availability of parking on the roadway, and turning movements interrupting the through flow.

Figure 2.4.2 on the preceding page displays the existing average daily traffic volumes on certain roadway segments of major facilities in the study area. Comparing these volumes to the daily service volumes (roadway capacity) under the appropriate width category (Table 2.6.1), identifies the existing level of service. Table 2.6.2 shows the average level of service by town and major facility through it. The analysis was not performed by specific intersections or roadway segments because complete data for this type of analysis was not available. However, Table 2.6.2 is descriptive of the operating conditions on the basic highway network of MetroWest.

Travel conditions on the Massachusetts Turnpike throughout the study area appear to be comfortable, especially in Southborough between interchanges 11A and 12, and in Framingham between interchanges 12 and 13. Generally, traffic flow is free (LOS "A") to stable (LOS "C"), and a driver's ability to select his own speed, change lanes, or pass ranges from unrestricted (LOS "A") to relatively satisfactory (LOS "C").

The corridor of Routes 9 and 30 operates under Level of Service "F". This level describes a forced flow operation at low or even zero speeds. The worst conditions exist in the sections of the corridor in Framingham and Natick, because that portion of the corridor not only serves local traffic, but a large number of through trips. For example, traffic within the communities of Hopkinton, Ashland, Holliston, Milford and Medway destined for the greater Boston area can only achieve access to interchange 13 of I-90 via Route 9 in Framingham.

In addition to supporting excessive east-west traffic, the corridor of Routes 9/30 also handles a significant amount of north-south traffic. Many motorists using Routes 27 and 126 make a portion of the trip on Route 9 or Route 30. Although these north-south movements do not comprise the majority of trips on Routes 9/30, given the problems on Route 9, any additional volume only worsens the existing conditions.

In the north-south direction, with the exception of Route 27 between Route 135 and Route 9 in Natick, operating conditions are borderline. Speeds are generally low and volumes at or near the capacity of the roadways.

Approximate Peak Hour Operating Speed (MPH)	Traffic Volumes All Lanes						Level of Service
	2-Lane		4-Lane		6-Lane		
	Peak Hour[a]	Daily[b]	Peak Hour[a]	Daily[b]	Peak Hour[a]	Daily[b]	
35	<250	<4,150	<800	<13,330	<1,300	<21,500	A
30	250	4,150	800	13,300	1,300	21,500	B
25	375	6,250	1,200	20,000	1,950	32,500	C
20	450	7,500	1,440	24,000	2,340	39,000	D
15	500	8,333	1,600	26,600	2,600	43,300	E
10	>500	>8,333	>1,600	>26,600	>2,600	>43,300	F

a. One-way
b. Two-way (assumes a peak hour factor (K) = 0.10 and a directional factor (D) = 0.60)
Source: Adapted from Highway Capacity Manual (56).

TABLE 2.6.1

ARTERIAL LEVEL OF SERVICE VOLUMES

Roadway	Ashland	Framingham	Natick	Southborough	Sudbury	Wayland	Wellesley	Weston
I-90		A/B	B/C	A		B/C		B/C
Route 9		F**	F*	F			F*	
Route 30		F**	F*	F*		F		E/F
Route 135	E/F	F	E/F				E/F	
Route 16			E/F				N/A	
Route 20					N/A	N/A		F**
Route 126	E/F	E/F				E/F		
Route 27			F**		E/F	F		
Route 85				E/F				
Wellesley Street							F	A

N/A - Volume not available.
* - Increasing number of stars indicates the severity of traffic congestion and delays.

TABLE 2.6.2

EXISTING LEVEL OF SERVICE BY TOWN AND ROADWAY SEGMENT

Another measure which describes travel conditions in the area is the percent of the vehicle miles traveled daily in peak hours under a given level of service. Analysis of highway and traffic data indicates that 100% of the vehicle miles traveled in the peak hours on MetroWest's arterial system is worse than Level of Service "E".

Public Transportation

Rail

Of the study area communities, only Framingham, Natick, and Wellesley have commuter rail service to Boston. In 1980, the 3 towns were served by 7 trains per day. An audit from March 1980 shows that 1,317 passengers were carried to Boston on the Framingham rail branch with 66 percent of the passengers from study-area communities. In particular, of all MetroWest boardings, 6% were from Ashland, 17% from Framingham, 19% from Natick, 2% from Southborough, 3% from Wayland, 49% from Wellesley, and 4% from Weston. Of the total boardings at the Framingham, Natick and Wellesley Farm stations, the majority of the commuters drove or were driven to the station, while at Wellesley Hills, most commuters walked to the station.

Currently (1984), there are 9 round trips daily between Boston and Framingham. Data on 1983 inbound daily ridership shows an increase of 35% over the 1980 ridership, with 89% of the boardings from study area stations.

Bus

The Gray Line Company operates commuter buses between Worcester and Boston. All buses stop at Shopper's World. Express buses connect directly from Shopper's World to downtown Boston via the Massachusetts Turnpike. Continental Trailways operates from a terminal near the intersection of Route 30 and Speen Street. Greyhound, Peter Pan and other intercity bus lines also utilize the Trailways terminal.

MBTA bus route 531 serves Framingham, Natick and Wellesley to Newton Corner. In addition to Gray Lines, private carriers--Wellesley Fells and Ritchie Brothers - service portions of the study area north of the Framingham and Natick downtown areas; Wellesley Fells and Big W Transport serve Ashland and the area of Framingham south of downtown.

The town of Natick operates a successful two route system for 8.5 hours daily. The two 18 passenger mini-buses serve 30,000 passengers per year, mostly shoppers, students, and part-time workers. The routes loop around the northeast and southwest Natick neighborhods each hour. The portion of the two routes through downtown and Shopper's World overlap, and that area has service every half-hour. Connections to the MBTA route 531, Gray Line, and rail are available along the routes. Twenty-five percent of the operating cost currently comes out of the farebox. This good system performance raises possibilities for service expansion into the early morning hours to serve the working population of Natick.

TRAFFIC FORECASTS

Growth of Travel

The growth of travel on roadway links is a result of an increase in the number of trips made due to changes in community population and employment. The 1990 population and employment forecasts were made available to CTPS by MAPC.[1] The 1990 employment forecast includes the employment growth from the specific development taking place in MetroWest communities. The process by which the base year trips were updated to reflect future population and employment levels is a computerized iterative algorithm called the Fratar technique. The algorithm output created the 1990 trip table, which in turn, was assigned to the highway network of the study area, as previously described. The Fratar expansion shows that among trip types, trips between MetroWest communities increase the most, by 12%, while through trips increase only 5%. Trips between MetroWest and the external area increase at a moderate 9%.

A comparison of the 1980 link assignments to the 1990 link assignment reveals the MetroWest increase in traffic. Link traffic growth ranges from a low of a 4% increase between interchanges 13 and 14 of I-90 to a high of a 25% increase on Route 85 south of Route 9. The average traffic growth is 11%. The increase in traffic on a particular link is a combination of its geographic location, and the origin, destination, and type of trips it carries, as well as the base year volume loaded on it. Generally, it appears that the traffic increase is consistent with the average population and employment growth for the area and with the rest of the state. Mapping traffic growth indicates the following:

- At the town level, average traffic growth ranges from 7% to 15%, with Ashland traffic growing by 15%; Framingham by 10%; Natick by 9%; Southborough by 13%; Sudbury by 16%; Wayland by 13%; Wellesley by 7%; and Weston by 8%.

- At the facility level, Massachusetts Turnpike traffic increases the least of all other facilities--an average of 5%. This result is consistent with the assumption that I-90 is used in the area primarily for long distance, slow-growing through trips. Traffic along the east-west major facilities grows by an average of about 10%, with increases higher than the average occurring in Ashland, Southborough, Framingham and Natick segments of the roadways. Traffic on Route 20 along the northern communities of Sudbury, Wayland, and Weston, is also increasing more quickly than the east-west average for the area. However, the increase is slight (11%) with most of the growth occurring in Sudbury.

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1. Information describing the forecast methodology is contained in Appendix B.

- In the north-south direction, traffic increases generally faster than in the east-west direction. In the corridor of Routes 126 and 27, traffic volumes will be about 14% higher in 1990. Most increases will be observed at the points where the corridor intersects the boundaries of MetroWest, Natick, Ashland, and Sudbury. Finally, Route 85 in Southborough will have an additional load as high as 20% of the existing (1980) traffic. However, it should be noted that although the north-south movements appear to increase at a higher rate than the traffic in the east-west direction, the increase in the absolute number of trips is small. The high percentages of increase in the north-south corridors are partly due to the generally smaller base volumes which occur currently in that direction.

Predicted Level of Service

Based on the results, a Level of Service summary is presented in Table 3.4.1 for 1990, which is similar to Table 2.6.2 for 1980. The table was prepared under the assumption that no major facility construction will take place before 1990 (no-build scenario). Comparison of the two tables indicates a further deterioration of traffic conditions along Route 9 and sections of Routes 135, 85, and Wellesley Street in Framingham, Southborough, and Wellesley, respectively. The Massachusetts Turnpike moves to lower levels of service, but still maintains acceptable traffic flow conditions.

In conclusion, it appears travel conditions in the MetroWest area will become chaotic in 1990 if proper measures to accommodate traffic are not taken. An indication of the seriousness of the situation is the following finding. Currently, 20% of the arterial mileage in the area is 4-lanes wide. In order to reach an acceptable Level of Service "C", 55% of the arterial mileage should increase capacity by 50% (become 4 lanes wide).

ALTERNATIVES

The nature of the problems in the MetroWest subregion suggests a variety of solutions. A discussion of alternative solutions should be developed which addresses some of the area's problems follows.

While the methodology used to perform the anal sis here is almost the same as it would have been if a detailed corridor analysis were undertaken, the data are--in some instances--only the best estimates available to us. Input of actual data would involve extensive collection of traffic signal permits, traffic volumes, turning movements, and a series of computerized traffic assignments for each of the proposed solutions.

The following sections present a discussion of the alternatives and a summary of findings.

Roadway	Ashland	Framingham	Natick	Southborough	Sudbury	Wayland	Wellesley	Weston
I-90		A/B	C/D	A/B		C/D		C/D
Route 9		F**	F**	F*			F**	
Route 30		F**	F*	F*		F*		E/F
Route 135	E/F	F	E/F				E/F	
Route 16			E/F				N/A	
Route 20					N/A	N/A		F**
Route 126	E/F	E/F				E/F		
Route 27			F**		E/F	F*		
Route 85				F				
Wellesley Street							F*	A

N/A - Volume not available.

* - Increasing number of stars indicates the severity of traffic congestion and delays.

TABLE 3.4.1

1990 LEVEL OF SERVICE BY TOWN AND ROADWAY SEGMENT

- East-West Roadway Improvements
  - Route 9 and Route 30 widening
  - Separation of Route 30 from Route 9 in Framingham
  - Elevation of common right-of-way of Routes 9 and 30
  - Grade separated interchanges
  - Removal of tolls from the Massachusetts Turnpike
- North-South Roadway Improvements
- Transportation Systems Management (TSM) Measures
- Public Transportation
- Land Use Control

The first two groups of alternatives (with the exception of the I-90 toll removal), deal with direct roadway capacity additions; the latter three deal with travel demand modification by diverting trips to other modes of transportation or to other facilities, or by reducing the number of trip attractions.

The following discussion of alternative solutions centers around their ability to accommodate 1990 traffic volumes. Where available information made it possible, cost estimates are also presented.

East-West Road Improvements

Route 9/30 Corridor Roadway Widening

The Route 9 corridor between Routes 128 and 495 is generally so over-burdened that the only traffic flow improvements to be considered should be major action projects, which basically means gaining additional capacity through widening. The exact number of additional lanes would have to be determined through a corridor type of analysis extending beyond MetroWest's western boundaries; however, it appears that there should be at least one lane added in each direction. Route 30 also requires widening by two or more lanes.

Table 1 summarizes the future level of service of certain roadway segments under two roadway capacity alternatives. Alternative A1 represents a 50% capacity increase and Alternative A2 represents a doubling of roadway capacity (100% increase). Therefore, under A1, Route 9 becomes a 6-lane facility and under A2 it becomes an 8-lane facility. Both schemes offer a significant improvement in the level of service over that presented in Table 3.4.1.

TABLE 1

1990 Level of Service by Alternative Widening Scheme and Town Roadway Section

WIDENING ALTERNATIVE A1 (50%)

Town/Route	9	30	135	16	20	126	27	85	Weston Road
Ashland			C/D			C/D			
Framingham	C/D	F	E			C/D			
Natick	C	F	C	C/D			E		
Southborough	B/C	F						F	
Sudbury					N/A		E		
Wayland		E			N/A	C/D	F		
Wellesley	C		C	N/A					F
Weston		E			F				

WIDENING ALTERNATIVE A2 (100%)

Ashland			B/C			B/C			
Framingham	C	F	D			B/C			
Natick	B/C	D	B	B/C			D		
Southborough	B	D						F	
Sudbury					N/A		C		
Wayland		C			N/A	B/C	E		
Wellesley	B/C		A	N/A					E
Weston		C			D				

Under the 6-lane alternative, the least effective of the two plans, travel flow conditions become stable. However, the analysis performed here is for link capacity along roadway segments which describes only part of the roadway's operating conditions.

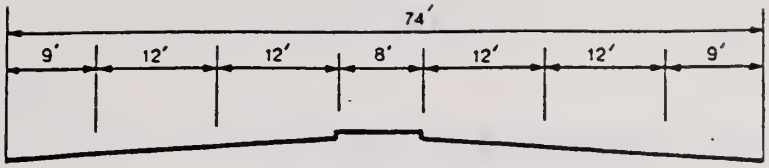
Level of service is usually controlled by the intersections along a roadway. For this reason intersection improvements should be considered along with any widening of Route 9. These improvements could range from simple retiming to grade separation. At this stage of preliminary analysis, the following locations appear to cause the most significant traffic disturbances upstream:

- Merging of Route 9 and Route 30
- Route 9 at Prospect Street in Framingham
- Route 9 at Temple Street in Framingham
- Route 9 at Oak Hill in Southborough

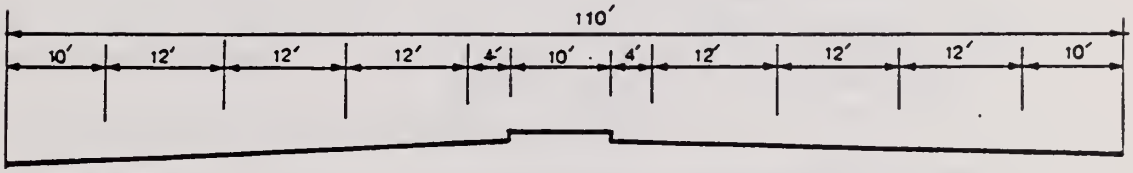
Figure 1 shows typical cross-sections under the existing conditions and the two widening alternatives. Presently Route 9 is 70 ft. to 76 ft. wide with 9 ft. shoulders and a variable 28 to 6 ft. median. Under the two widening schemes the total right-of-way will increase to 110 ft. and 134 ft. respectively. Both designs require a significant amount of land. The value of this land would be difficult to estimate accurately at this level of analysis. However, a conservative estimate for the approximately 17.3 mile length of Route 9 in MetroWest is $40 million for 6-lanes and $60 million for the 8-lane design. Construction costs are shown in Table 2.

Table 1 also shows the effects of 50% and 100% capacity additions to Route 30. A 50% capacity increase of Route 30 is a minor widening by one lane. Such a lane could accommodate vehicles turning into major developments and cross streets. It could also reduce delays for through traffic by removing turning vehicles from the traffic stream. However, as Table 1 indicates, a one-lane widening of Route 9 is not sufficient to improve traffic flow. Again, as in the discussion on the Route 9 widening, the above alternative for Route 30 must be examined as a package with intersection improvements and capacity increases on Route 9.

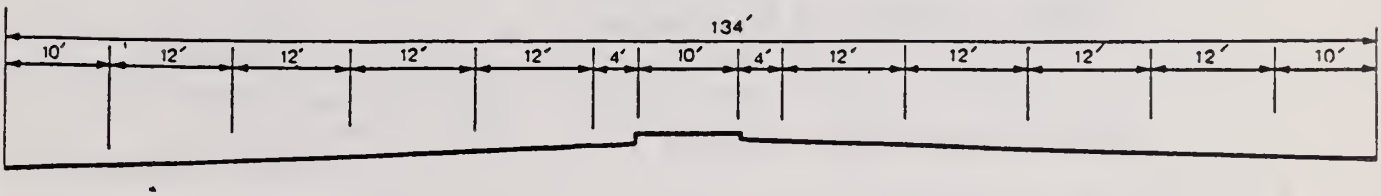
Designing Route 30 to a 4-lane roadway improves matters markedly. Except for the section of Route 30 in Framingham, all other sections could operate at acceptable levels of service. The Framingham section of Route 30 continues to cause severe congestion and delays because of the high volume it carries, coupled with curb cuts at the Mall area and backups at intersections. The Route 30 and Route 126/Route 30 projects of the Department of Public Works, presently in the 2-5 year element of the Transportation Improvement Program, are expected to alleviate some of these problems.



Existing typical cross section along route 9



A1: Six lane cross section



A2: Eight lane cross section

scale 1'= 20'

ROUTE 9 - ROADWAY CROSS SECTIONS

Figure 1

TABLE 2

Cost Summary

Alternative	Cost in 1984 Dollars[1]
• East-West Roadway Improvements	
a. Route 9/30 Corridor Widening (17.2 miles)	
- 50% Capacity Increase	$36 Million[2]
- 100% Capacity Increase	$50 Million[2]
b. Separate Right-of-way for Route 30 in Framingham (2 lanes, 1.1 mile)	$ 5 Million
c. Elevation of Route 30/Route 9 Right-of-way in Framingham (2 lanes, 1.1 mile)	$20 Million
d. Grade Separated Interchanges	$10 Million
e. Toll Removal from I-90	$33 Million[3]/yr.
• North-South Roadway Improvements	$ 5 Million[4]
• Transportation Systems Management	Minimal
• Public Transportation	
- Local Transit (8 minibuses)	$180,000 (capital cost) $312,000/yr. (operating cost)
- Rail/Light Rail Vehicle	Excessively High
• Land Use Control	Loss in Tax Revenue

[1]These are constructions costs only. Right-of-way costs are not included.
[2]Includes intersection improvements.
[3]Revenue loss.
[4]Some of these funds have already been committed to projects.

Separation of Route 30 from Route 9 in Framingham

This alternative separates the flows of Route 30 and Route 9, with Route 30 used as a service roadway for local traffic and Route 9 as a semi-limited access facility to accommodate the through traffic better. In terms of capacity increase, this scheme can be considered as adding a number of lanes (see Table 1) to the portion of the Route 9 corridor between the triangle and the merging point of Pleasant Street and Route 9 east of Framingham Center. For greater effectiveness it is envisioned along with:

- Replacement of the Route 9/Route 30 merging with a grade separated intersection.

- Limitation of access of minor streets, including Prospect Street, to Route 30 only.

It is believed that this design, in addition to accommodating through trips on Route 9, improves the traffic conditions upstream on Route 30, and channels the heavy turning flows from side streets, especially Prospect Street, through Route 30 to Route 9 without interferences. Table 2 shows the expenses involved.

Elevation of Common Right-of-Way of Routes 9 and 30

Currently, the portion of Route 9 which shares the right-of-way with Route 30 carries an average daily traffic of approximately 45,000 vehicles. Normally, this high volume should be accommodated by a roadway 8 lanes wide. Elevating this segment of Route 9 would allow through trips to use an upper level express, while local trips would continue to use the existing at grade facility.

This design suggestion takes into consideration that there is no right-of-way immediately available for the widening of the Route 9/Route 30 roadway link. Again, as above, this alternative is viewed as adding 2 lanes to the existing facility. The expected level of service is shown in A1/Framingham of Table 1. Another possible scheme for the elevated structure would be to operate it as a one-way loop. The eastbound traffic would use it during the morning peak period and the westbound traffic in the evening peak.

This alternative would not require extensive right-of-way expansion along the roadway itself; however, in order to access the elevated structure a significant amount of land would be needed for ramps.

Grade Separation

Congestion is not caused by high volumes alone. At grade intersections, especially when they are inadequately controlled, often cause traffic accumulation upstream and accidents. Grade separated intersections channel the separated traffic streams effectively and should be studied as an alternative by themselves or in coordination with roadway widening in the corridor. For example, a number of locations along the Route 9 corridor in Framingham and Southborough have been identified as having severe capacity deficiencies. These are: Route 9/Route 30/Route 126 merging point; Route 9 at Prospect Street, Temple Street and Oak Hill.

Roadway capacity is, for the most part, controlled by intersections. The duration and phasing of the traffic signals determines the amount of time available for through traffic to proceed. By redesigning an at grade intersection to a grade separated one, the loss of roadway capacity from signals and turning movements is totally eliminated.

Removal of Tolls on the Massachusetts Turnpike

This alternative would reduce the out-of-pocket travel cost on I-90, and the removal of the toll booths would increase the average speed. It is expected that as many as 7,000 vehicles a day could be diverted to I-90 from the Route 9 corridor. However, this volume is not sufficient to bring the Route 9 corridor to normal levels of operation. It is possible that this measure could prove helpful if used in combination with other alternatives.

The removal poses two serious issues which must be considered. As previously mentioned, the problems along Route 9 extend beyond the western boundaries of MetroWest. The elimination of tolls on I-90 may divert some traffic, but the location of interchanges on the Massachusetts Turnpike, makes it impractical to eliminate tolls without improving access. Access improvements should be considered throughout the entire corridor in an attempt to divert as many through trips as possible from Route 9 to I-90. Thus, the first issue which should be addressed, if tolls are to be removed from I-90, is how access to I-90 should be improved. Several locations where improved new access to I-90 should be considered are:

- reconstruction of I-90/Route 30 interchange
- reconstruction of I-90/Route 9 interchange now located 1/2 mile west of the Framingham/Southborough line
- creation of an interchange between I-90 and Route 85 in Southborough
- creation of an interchange between I-90 and Oak Hill Road in Ashland
- creation of an interchange between I-90 and Pleasant Street (Route 30) in Framingham

The second serious issue associated with this alternative has to deal with I-90 itself. To remove tolls from I-90 and add more interchanges between I-90 and local roads may undermine the integrity of I-90. I-90 is viewed as a link between Holyoke/Springfield, Worcester, and the state capital. To undermine the integrity of this key east/west road to satisfy the needs of one area could become a difficult political issue.

North-South Roadway Improvements

Short Term

Our analysis does not show the need for urgent capital intensive improvements in the north-south direction. For the immediate future, the problems along the north-south roadways can be addressed locally by improving intersections through changes in geometrics, provision of left-turn bays, or signal timing adjustments. Many of the identified trouble spots have been studied and advertised for construction by the Massachusetts Department of Public Works; others are listed for advertisement or design in the annual or 2-5 year element of the 1984-1988 Transportation Improvement Program (TIP) for the Boston region.

Table 1 includes the effect of widening of major north-south roads on their level of service. Here widening is considered not so much a realistic alternative as a method to help understand the effects of additional capacity. It appears that turning these roadways into 3-lane facilities (with a reversible center lane) would alleviate a large portion of the problems. However, the same effect can be achieved by providing left turn lanes with extended storage at the approaches to intersections along Routes 126, 27 and 85. In other words, this is an indication that the problems on the north-south facilities are more localized and their intensity allows them to be addressed by improvements at the intersection level.

Table 4.1.1 contains a list of locations requiring improvements and the proposed timetable.

Long Term

As discussed earlier, Route 9 handles a significant amount of north-south traffic, because of the lack of a major artery with a true north-south orientation in the MetroWest area. The option of a north-south connector is an idea to discuss for the far future. A possible location could be between Route 126 and Route 85, extending from Route 16 in Holliston to Route 27 in Sudbury, with appropriate interchanges at Routes 135, I-90, 9, 30, and 20.

Transportation Systems Management (TSM) Measures

This alternative, as the only improvement option would not satisfy the area's traffic problems; but, in conjunction with other measures such as those discussed above, could improve traffic flow further. Under TSM alternatives, the focus is on the redistribution of the existing or anticipated traffic rather than on increasing the right-of-way to accommodate it. These measures are usually low cost and can be implemented in a fairly short time. Traffic signal retiming, carpooling, and staggered or flexible work hours are only some of the TSM options to consider.

Community	Location	Improvement	Action
Ashland	Reconstruction of Main St. from Myrtle St. to Rt. 135, Pleasant St. from Main St. to High St., Front St. from Main St. to River Bridge, Homer St. from Main St. to Rt. 135, and Cherry St. from Main St. to Pleasant St.	Reconstruction	2-5 Yr. Element
Ashland	W. Union St., Summer St., Cherry St., Union St., Chestnut St., Homer St./Union St., Fountain St., Main St., Prospect St., Chestnut St./Pond St., Eliot St., Union St., Main St.	Traffic	Annual Element
Framingham	Rt. 126 and Rt. 30.	Construction	2-5 Yr. Element
Framingham	Rt. 126 at downtown Framingham.	Traffic	
Natick	Rt. 135 at Rt. 27	Traffic	2-5 Yr. Element
Southborough	Rt. 85 over Conrail	Bridge Replacement	2-5 Yr. Element
Sudbury	Rt. 20 at Nobscott St.	Traffic	2-5 Yr. Element
	Peakham Rd. and Rt. 20	Traffic	2-5 Yr. Element
	Concord Rd. and Rt. 20	Traffic	2-5 Yr. Element
Wayland	Rt. 27 and Plain St.	Reconstruction	2-5 Yr. Element
Weston	Five locations along Rtes. 20 and 30	Traffic	2-5 Yr. Element

TABLE 4.1.1

LOCATION OF PROPOSED IMPROVEMENTS TO NORTH-SOUTH TRAFFIC FLOW

Ridesharing

Ridesharing is a collective term used for carpools, vanpools, and bus or taxi-subscription service. The goal of ridesharing is to reduce traffic congestion by providing a lower cost, higher vehicle occupancy mode of travel.

There are several state programs promoting and organizing ridesharing. However, attracting drivers to this mode of travel has been difficult, because of the inconvenience of having to share a vehicle with others and the increase in out-of-vehicle travel time. This alternative, although it should be encouraged even under normal traffic operation conditions, is not expected to offer the required relief to the traffic problems in the area.

Staggered or Flexible Work Hours

This measure is intended to shift travel demand over time. By extending the arrival or departure rate of employees over a longer period of time the peak hour traffic spreads out. This allows the transportation networks to function and reduces travel time for commuters. Committed employer participation is very important for these programs. It is equall important for new developments in the area to participate in order to maintain a high quality level of service.

Public Transportation

Regional/Local

A local mini-bus system similar to that operating in Natick would be a desirable alternative to automobiles for a variety of local trip purposes. Students, who mainly rely on being dropped off, elderly, and part-time workers could rely on such a system. A number of these buses could also be used early in the morning before the off peak shopping demand as feeders to express buses and commuter rail, or be operated as subscription buses driving workers to specific facilities (e.g., hospitals). In the evening, when the demand for shopping trips drops to a low, the vehicles could operate as distributors from bus terminals or rail stations.

The Natick two mini-bus system now carries approximately 110 passengers per day. If this system expanded to an 8 bus regional system, assuming the same level of service, approximately 900 people would be served daily. This number of trip makers translates to roughly 600-700 cars/day taken off the roadway system, a traffic volume too low to have any substantial effect on congestion.

Long Distance

Commuter rail is currently provided to Framingham Center, West Natick, and Natick. However, access to these stations is difficult during peak hours, and parking is limited.

One long distance transit option would be to investigate a high speed commuter rail facility from Worcester to downtown Boston with stops in major communities on a route paralleling Route 9. This alternative is extremely expensive, but it should be investigated as a means of alleviating through traffic on Routes 9 and 30.

Another long distance travel option is the extension of the MBTA Green Line beyond Riverside along the Route 9 corridor, and extending beyond the commuter rail terminal at Framingham Center. Although as expensive as commuter rail, the advantage of this alternative over the rail option is that it can also be used for internal travel.

Either option--commuter rail or Green Line--would need a right-of-way at least two roadway lanes wide, and space for commuter parking. In addition, the success of these options with regards to travel demand diversion is doubtful.

Land Use Control

In addition to capacity increase and other level of service alternatives, thought should be given to land use control from a trip generation point of view. Some types of land use produce or attract more trips than others. Among the lowest trip generators are research and development offices with 9.3 trips per day per 1,000 sq. ft. and general manufacturing and industrial parks with 4.2 to 8.8 trips per day per 1,000 sq. ft. Land use control could be particularly useful in cases of land reuse or for communities which have not yet experienced their full growth.

Summary of Findings

Based on existing and future travel patterns in the MeteroWest area a preliminary analysis of the deficiencies in roadway capacities has been presented. A number of solutions were also suggested and analyzed. The major findings are as follows:

Roadway Improvements

- Traffic operating conditions on Route 9 become "tolerable" by adding one lane to each direction of travel and "stable" by adding two lanes to each direction.

- Only a four-lane cross section along Route 30 could accommodate the expected traffic volume by 1990.

- Although the exact benefit from grade separating a number of intersections along the Route 9/30 corridor cannot be completely quantified at this level of analysis, the effect on Route 9/30 capacity is definitely positive.

- o Removal of tolls from I-90 is not a viable alternative. The effect of this measure on Route 9 traffic is minimal and the loss of revenue to Masspike Authority makes it politically unacceptable.

- o North-south roadways will not require major capacity work by 1990. Improvements could be achieved through projects at the intersection level, e.g., geometrics, traffic signal retiming and removal of parking.

Transportation Systems Management

- o Ridesharing and flexible or staggered work hours will have positive impacts on the MetroWest roadway network.

- o However, TSM measures are not expected to reduce traffic volumes significantly (only 5 to 10%).

Public Transportation

- o Local transit could serve a social purpose in MetroWest but it is not "the solution." The diversion to buses is expected to be minimal, removing an insufficient number of cars from the roadway system.

- o High-speed rail and Light Rail Vehicles (LRV) service are unacceptable solutions because they will attract only a small portion of the trips made, and their construction will consume valuable rights-of-way.

Land Use Control

- o Land use control by trip generating rates or other forms of restriction is an effective measure for maintaining traffic volumes at acceptable levels.

WATER SUPPLY IMPACTS

Growth and development within the MetroWest region will affect the area's water supplies as new offices, businesses, and residences use additional water. As more and more communities face supply problems, due to contamination or shortage, it is important to be aware of the impacts of growth. Beyond increased consumption of water, growth may affect supplies through contamination of groundwater, reduced groundwater recharge and increased exportation of water through sewer systems.

This analysis presents information on MetroWest's sources, supplies, current use and projected demand for water. MAPC has also estimated the water needs of the known development occurring and proposed for each community. This information has been used to develop recommendations for individual and regional actions that will insure adequate, safe water supplies for the future.

The MetroWest region appears to have adequate supplies to serve the expected growth. However, it is important to remember that most of MetroWest relies on vulnerable groundwater, and that groundwater requires recharge mechanisms to replenish supplies. Further, communities served by the MDC system, whether by contract or as a member, should realize that the MDC is currently exceeding its safe yield levels.

Current Sources

The 8 communities in the MetroWest region draw their water from local wells and/or the MDC supply. Four of the 8 communities are completely dependent upon local groundwater, while 2 communities are completely supplied by the MDC. Framingham draws most of its water from the MDC, relying on local wells for 20% of its needs. Wellesley currently relies on local groundwater, but as a MDC member community it is legally entitled to draw from the MDC supply.

Four of the MetroWest communities have some level of sodium contamination in their local supplies. The most severely affected community is Weston, which was forced to close two municipal wells. Table 1 lists the MetroWest communities' supply sources and contaminants.

TABLE 1

WATER SUPPLY AND QUALITY

	Sources	Contamination
Ashland	2 wells	under study
Framingham	80% MDC, 20% - 3 wells	elevated sodium levels (local wells)
Natick	10 wells	elevated sodium levels
Southborough	MDC	none
Sudbury	5 wells	none
Wayland	7 wells	none
Wellesley	6 wells	elevated sodium levels
Weston	MDC	town wells closed by sodium contamination

Notes:

1. Massachusetts Water Supply Systems, Massachusetts Department of Environmental Management, January 1983

2. Water Quality Issues in Massachusetts Chemical Contamination, Special Legislative Commission on Water Supply, October 1981

Use, Demand and Supply

Evaluating the impact of growth in the MetroWest region on water supply requires information on recent water use, projected demand and safe yield. A number of recent studies, most notably the ongoing MDC water supply study, have examined these factors. Table 2 combines data on 1980 water use in the individual communities, two 1990 demand projections, and two safe yield estimates. It should be noted that the MDC figures are the most recent, and are generally considered more reflective of current conditions.

It is noteworthy that 1980 water use in Natick, Wellesley and Weston was almost equal to the MDC projections for 1990, indicating that little growth in demand is expected in those communities. In addition, one of Ashland's 1990 projections exceeds its safe yield level. The other MetroWest communities' water use figures fall below the 1990 projections and safe yield levels.

Recent use, projected demand and safe yield figures provide a baseline against which growth impacts can be assessed. MAPC has evaluated the proposed development for the MetroWest region and has developed estimated water use levels for the development expected in each community. Proposed development was combined by type, and standards for water use were applied. Water use levels were calculated using the following use factors:

Commercial Retail	150 gallons per day/1000 sq. ft.
Hotels	110 gallons per day/room
Industrial	85 gallons per day/1000 sq. ft.
Office	80 gallons per day/1000 sq. ft.
Residential	300 gallons per day/unit

The result is Table 3, which illustrates the total size of development for each community, proposed number of residential units and the estimated water use of the development--both in total and as a percent of the 1980 community use.

TABLE 2

WATER USE AND SUPPLY (mgd)

	WATER USE	DEMAND PROJECTIONS		SAFE YIELD	
	1980	1990 (EOEA)	1990 (MDC)	1982 (MDC)	1983 (DEM)
Ashland	1.16	2.21	1.31	2.05[b]	1.73[e]
Framingham	8.61	9.69	8.79	2.50[b]	10.92[e]
Natick	4.45	5.92	4.43	7.50[c]	7.44[f]
Southborough	.52	.81	.62[a]	.72[c]	.52[f]
Sudbury	1.42	2.23	2.40[a]	4.86	3.86
Wayland	1.65	2.63	2.11[a]	4.90[d]	3.00
Wellesley	3.05	4.22	3.01	5.20[d]	5.20[f]
Weston	1.14	1.75	1.12	-	1.14[f]

1. Water Demand Projections, Metropolitan District Commission, January 1983, MAPC, January 1984.

2. Massachusetts Water Supply Policy Statement, Executive Office of Environmental Affairs, May 1978.

3. Task 1: Water Demand Projections, MDC, January, 1983

4. Task 1: Water Demand Projections, MDC, January, 1983

5. Massachusetts Water Supply Systems, Massachusetts Department of Environmental Management, January 1983

a. Preliminary estimates

b. Local Supply only. MDC contract volume = 20.15

c. MDC current contract volume.

d. MDC member community.

e. MDC use plus local supply safe yield. See b.

f. MDC actual use, not safe yield.

The most notable impact occurs in Ashland, where projected development will consume almost 350,000 gallons per day, or a 30% increase over 1980 consumption. As in the other MetroWest communities, however, the combined total of the 1980 use and the projected development use in Ashland will not exceed the lower of the two safe yield estimates.

Table 3 also shows the totals for development and projected water use in sewered and non-sewered communities. Most of the projected development will occur in sewered communities, resulting in consumption of over 1 million gallons per day. The distinction between sewered and non-sewered is especially important for the communities of Ashland, Natick and Wellesley where all supplies are drawn from groundwater and wastes are handled through sewer systems. In effect, water drawn from local aquifers is then exported out of the community via the MDC sewer system. This reduces the recharge of local aquifers which would otherwise replenish groundwater supplies. The proposed development in these communities means increased consumption and increased exportation of local water supplies.

Conclusions

Overall water supplies for the MetroWest region appear to be adequate to serve the current population and expected growth. Even in areas of significant growth and increased water demand, safe yield estimates will not be exceeded. Several communities--Ashland, Wellesley and Natick--are reportedly exploring new well sites. These efforts should continue so as to insure that additional local supplies will be available.

Adequate supplies of water for MetroWest are not the only issue of concern. The reliance of many of the communities on groundwater supplies makes protection of existing and future sources critical. In addition, recharge mechanisms for replenishing local supplies and limiting the exportation of water should be preserved. Several MetroWest communities already face contamination of local supplies, underscoring the necessity for protection. Ashland, Natick and Wellesley face the potential of exporting of an additional 500-750,000 gallons per day, emphasizing the recharge potential that is lost.

The basic water resources issues to be faced by the MetroWest region have less to do with the amounts of water available than with the protection of supplies from contamination, the reduction of exportation, and the improvement of recharge mechanisms.

ALTERNATIVES

Protection of local supplies and control of drainage methods and patterns are areas in which individual communities have some authority. As growth continues, threats to groundwater supplies may increase while recharge options may decrease. Consistent local control, implemented regionwide, can direct growth away from vulnerable supply areas and can increase recharge of groundwater supplies.

TABLE 3

Estimated Water Use for
Proposed MetroWest Development

	Proposed Development	Proposed Residential	Estimated Use	1980 Use	Estimate as % of 1980
Ashland	450,000 sq.ft.	984 units	349,700 gpd	1,160,000 gpd	30%
Framingham	3,803,500	296	468,100	8,610,000	5
Natick	1,325,100	320	241,700	4,450,000	5
Southborough	312,000	-	25,000	520,000	5
Sudbury	164,500	140	62,400	1,420,000	4
Wayland	-	296	88,800	1,650,000	5
Wellesley	221,000	-	17,700	3,050,000	.6
Weston	-	-	-	1,140,000	-
Totals	6,276,100 sq.ft.	2,036 units	1,253,400 gpd	22,000,000	6%
Sewered Communities	5,799,600	1,600	1,077,200	17,270,000	6%
Non-Sewered Communities	476,500	436	176,200	4,730,000	4%

Metropolitan Area Planning Council, January 1984

There are a variety of techniques available to communities seeking to protect groundwater. Described more fully in Appendix C, the regulatory and non-regulatory methods include zoning, orders of conditions, subdivision regulations, and board of health regulations. Local programs of water conservation, land acquisition and conservation restrictions may also serve to protect resources. Methods which control drainage patterns and techniques available for the storage and treatment of stormwater are likewise described. These techniques are available to communities in order to protect groundwater and/or enhance recharge systems.

All of the alternatives for protecting water supplies and enhancing groundwater recharge will be affected by new state regulations concerning interbasin transfer and groundwater discharge. In brief, the Water Resources Commission is currently developing regulations which would establish a permitting procedure regulating the interbasin transfer of water, which includes the transporting of wastewater through sewer systems. The Act establishing this procedure (Chapter 658, 1983) is included in Appendix C. The regulations will require a permit for increases in the amount of water transferred across basin boundaries. Additional details are available by contacting MAPC.

The Division of Water Pollution Control has issued regulations (314 CMR 6.00) concerning the classification of groundwater and regulating discharges into groundwater. A summary of the intent and details is also included in Appendix C. The regulations establish a classification system for groundwater similar to that used for surface water and regulate the quality of discharge allowed into groundwater.

WASTEWATER DISPOSAL IMPACTS ANALYSIS

New offices, businesses and residences will generate additional volumes of wastewater in all MetroWest communities. Growth and development in the sewered communities of MetroWest will have a direct impact on current capacity problems. In non-sewered communities, on-site disposal systems will be expected to handle current and future wastes, and facilities like the joint Sudbury/Wayland septage treatment plant will assist in handling wastes locally. In sewered communities, additional volumes will be handled by the local systems and the Framingham Extension Sewer (FES). The FES serves Ashland, Framingham and Natick, connecting to the Wellesley Extension Sewer (WES) and Wellesley Extension Relief Sewer (WERS), which in turn connect to high level sewers and the Nut Island treatment plant.

This section presents information, focusing mostly on the FES, indicating current wastewater flows and estimated future flows. Plans to remedy existing problems are discussed and a range of options is presented. Estimated wastewater generation volumes are presented for all the MetroWest communities, so that even those non-sewered communities may gain an understanding of the impact of development upon on-site systems.

The basic problem facing the sewered communities appears to be the inability of the FES to adequately carry peak period wastewater flows, which include significant amounts of infiltration and inflow. The result reportedly has been flooding and sewer overflows in streets, yards and basements in Natick, Wellesley and downstream communities. The MDC is involved in designing relief and replacement sewers for both the FES and WES/WERS systems.

Current Flows

Existing flows for the three communities served by the Framingham Extension Sewer (FES)-- Ashland, Framingham and Natick-- and flows for Wellesley are presented in Table 1. Flows are separated into categories of average use generated, average infiltration and inflow (I/I), and average total flow. Peak flows, which combine average use, peak I/I and a peak-to-average ratio are also included. The total flows handled by the FES (all communities except Wellesley) are also listed.

TABLE 1

EXISTING METROWEST WASTEWATER FLOWS[1] (mgd)

	Average Use Generated Flow	Average I/I	Average Total Flow	Peak I/I	Peak Total Flow
Ashland	.22	.26	.48	.56	1.11
Framingham	5.67	2.23	7.90	6.55	21.28
Natick	1.91	1.94	3.85	3.03	7.17[3]
Wellesley[2]	2.06	1.47	3.52	3.99	9.14[3]
FES	7.80	4.43	12.23	10.14	29.56

Notes:

1. A 201 Facilities Plan For Relief of the Framingham Extension Sewer, Volume 1, Metropolitan District Commission, September 1982.
2. Wellesley Extension Sewer, Draft Facilities Plan, Metropolitan District Commission, August 1982.
3. MAPC estimate

The FES has a design capacity of 17 mgd. Capacity exists to adequately handle average total flows, but during peak flow periods the FES is overburdened by nearly 12.6 mgd.

A major contributor to peak flow is the combined effect of infiltration and inflow. Infiltration is additional water which enters the sewer system through defective pipes, joints, connections, and manholes. Inflow is additional water which enters the system through roof, cellar, yard and foundation drains, and cross connections with catch basins and storm sewers. Table 1 indicates that even under average flow conditions, Ashland and Natick have more I/I flow than use generated flow. The MDC has estimated that sewer overflows occur approximately 7 times per year and the surcharge may last from one day to one week.

Future Flows

As development in MetroWest continues, wastewater flows will increase. The facilities plan prepared for the MDC estimates that by the year 2000 the average flows in the Framingham Extension Sewer, excluding I/I will be approximately 11.3 mgd, with peak flows including I/I over 41 mgd. Based on the development information collected from the MetroWest communities, MAPC has estimated the wastewater volumes to be generated by the development in each community. Standards for wastewater generation were applied in the same manner as water use estimates using the following factors:

Commercial/Retail	150 gallons per day/1000 sq. ft.
Hotels	110 gallons per day/room
Industrial	85 gallons per day/1000 sq. ft.
Office	80 gallons per day/1000 sq. ft.
Residential	250 gallons per day/unit

The resulting flows have been tabulated in Table 2, which lists by community the size of the expected development, the estimated flow generated by development, the existing average flow, I/I, and total flow, and the estimated 1990 total flow. MAPC's estimates are consistent with the MDC figures, showing an average flow excluding I/I of 8.8 mgd by 1990. Total average flow for 1990 is estimated at approximately 13.2 mgd.

More importantly, the estimates indicate an increase of .98 mgd in average wastewater volumes that must be disposed of in a system that is unable to handle peak volumes. MAPC estimates that this .98 mgd in average flow will translate into a 2.5 mgd increase in peak flow. Thus the current peak flow of 29.6 mgd is expected to increase to 32.1 mgd by 1990. Peak volumes will then be almost double the capacity of the FES.

These estimates do assume that all the wastewater generated by proposed development will be handled by the Framingham Extension Sewer (FES), while in fact some of the wastewater from residential development will not. In Ashland, where the most dramatic percentage increase in wastewater generation will occur, development being planned and under construction accounts for all 984 residential units with 300,000 gpd of wastewater slated to tie into the FES. This development will increase Ashland's wastewater flow by over 60% from 1980 levels.

Wastewater generation rates for nonsewered communities indicate the levels that on-site systems must handle in relation to the amounts of development proposed.

Conclusions

Overall wastewater flows in the Framingham Extension Sewer will increase as development in the southern portion of the MetroWest region increases. Current problems with overflows and flooding will also increase due to capacity problems during peak flows in the FES and the downstream Wellesley Extension and Extension Relief Sewers (WES/WERS).

The most immediate challenge facing the affected communities is to reduce peak period flows so as to reduce the incidence of overflows. The current sewer has the capacity to handle average flows, but cannot handle peak flows. It is unlikely that flows could be reduced sufficiently to eliminate the current problems, especially in light of the growth expected to occur. Increased structural capacity should be developed as part of long range planning.

The MDC is currently engaged in planning and design for the replacement of portions of the WES/WERS line and construction of a new Framingham Extension Relief Sewer. MDC has reported its intention is to construct both lines simultaneously to provide adequate capacity to all problem areas between Ashland and the Dedham/West Roxbury border.

TABLE 2

ESTIMATED WASTEWATER FLOWS (mgd)

	Proposed Development	Proposed Residential	Estimated Flow Generated	Existing Av. Flow	Existing Av. I/I	Existing Av. Total Flow	Estimated Av. Total 1990 Flow
Ashland	450,000 sf	984 Units	.30	.22	.26	.48	.78
Framingham	3,803,500	296	.45	5.67	2.23	7.90	8.35
Natick	1,325,100	320	.23	1.91	1.94	3.85	4.08
Southborough	312,000	-	.025	-	-	-	-
Sudbury	164,500	140	.035	-	-	-	-
Wayland	-	296	.089	-	-	-	-
Wellesley	221,000	-	.018	2.06	1.47	3.52	3.54
Weston	-	-	-	-	-	-	-
Totals	6,276,100 sf	2036 units	1.15	-	-	-	-
FES Communities (Ashland, Framingham, Natick)	5,799,600	1600	.98	7.80	4.43	12.23	13.21

Metropolitan Area Planning Council, January 1984

Some controversy surrounds these proposed lines. Questions of alternative treatment methods, location of sewer lines and pump stations, construction practices and general need have been posed. In the absence of other practical alternatives, the region should work toward acceptable design of the replacement and relief sewers. A number of alternatives such as satellite plants on the Charles River or in the SuAsCo basin, treatment with land disposal, and wetlands treatment methods have been proposed. Factors of cost, available land, treatment capacity in relation to the amounts of wastewater generated, EPA water quality standards, and concern for downstream water supplies combine to significantly limit the feasibility of these alternatives in the MetroWest region. Coupled with continuing efforts at peak flow reduction, currently planned improvements to the existing system should ultimately result in a wastewater disposal system capable of adequately serving the MetroWest communities.

ALTERNATIVES

As discussed earlier, the major wastewater disposal method available is the regional MDC system. However, individual communities have authority in a variety of areas which could be used to reduce or control wastewater flows. Local programs and regulations may be established to reduce peak flows, conserve water, or require special discharge or disposal methods.

Infiltration/Inflow Reductions

Local enforcement of regulations prohibiting the connection of contributors such as roof drains and sump pumps to local sewers will help decrease inflow during storms. Some communities in other subregions have resorted to building by building inspections by town officials in order to reduce the number of illegal connections. Continued local and state programs for rehabilitating sewer lines will also help lessen infiltration impacts.

Site Plan Review

Basic zoning and its variations--cluster, PUD, and phased development bylaws--control growth through restrictions on uses, densities and locations. Communities may wish to accept the underlying pattern of their current zoning but control the impact and complexion of the uses allowed. Site plan review bylaws are a potentially broad and powerful tool for achieving this control.

Site plan review is a process that allows various municipal evaluations of any development to occur within a single, simultaneous procedure.

Site plan review is not fundamentally a process for denying permits to a development. Provided that the project complies with zoning bylaws, subdivision regulations, health and building codes, the proposal should not receive a blanket denial by means of site plan review. The process, by contrast, should be viewed as a means of improving the quality of a development and minimizing its impacts. Site plan review should be considered to be a negotiating forum between the builder and the town. It can also benefit the developer by combining previously separate reviews.

Conservation

Water conservation measures, discussed in the Alternatives section of the Water Supply Impacts Analysis, will also reduce wastewater generation.

SOLID WASTE IMPACTS

Growth and development within the MetroWest region will affect the area's solid waste disposal capacity as new facilities generate additional waste. As more and more communities face disposal problems, an understanding of the impact of new generators becomes critical. Beyond increasing the production of solid waste and the need to dispose of it, growth will put a burden on the means of disposal, capacity of disposal sites, and cost of disposal.

The following analysis focuses on current disposal practices, projected solid waste generation, advantages and disadvantages of disposal methods, and the future management of solid waste. It is important to remember that all of the communities in the MetroWest region rely on the use of a diminishing resource, sanitary landfills, which are approaching their capacity.

Current Practices

In the MetroWest region, communities currently use three methods of waste disposal; local municipal landfills, commercial landfills, or incineration/landfills. Two of the 8 communities are dependent on a commercial landfill in Plainville for disposal of their solid waste. Four of the communities rely on their own local municipal landfills. Framingham and Ashland use incineration to reduce the weight and volume of wastes prior to final disposal at a landfill. Table 1 lists the MetroWest communities' methods and generation of waste disposal, and the number of years of use left in the landfills.

As indicated in Table 1, the number of use years remaining in landfills ranges from 6 months in Framingham to 16 years in Sudbury. Framingham is working under a 6-month extension for their landfill, which will be closing soon because the site has been sold. The town will soon have to contract for use of an outside landfill. Weston has 2.5 use years left in its landfill. The town is trying to locate a new site. If this proves unsuccessful, it too will have to rely on another town or a commercial landfill for disposal of its solid waste. Wayland has 10 to 12 years of use remaining in its landfill, but a liner is now required by order of the Department of Environmental Quality Engineering (DEQE).

These examples provide insight into the nature and complexities of the management of solid waste in communities with their own landfills. Complicating the situation is the inability of the commercial landfill in Plainville, used by 2 MetroWest communities at the present time, to continue to receive solid waste from these or additional communities for an extended period. Although Plainville is the proposed site for a resource recovery facility (128 West), the number of use years left in the landfill without such a facility is only 5 to 6. The landfill is allowed to take in 750 tons of solid waste per day, and is close to maximum capacity now. Given the increase in solid waste from developments in the MetroWest region, and the problems with local landfills, the capability of this landfill to meet future demand is currently in doubt.

TABLE 1

METHODS AND GENERATION OF WASTE DISPOSAL

	Method of Waste Disposal	Waste Generated/Year	Years Left in Landfill
Ashland	Incineration in Framingham	4,680 tons/yr.	N/A
Framingham	Incineration/Local Landfill	61,000 tons/yr.	6 months
Natick	Local Landfill	25,000 tons/yr.	7 years
Southborough	Commercial Landfill	6,000 tons/yr.	5-6 years*
Sudbury	Local Landfill	9,000 tons/yr.	10.4-16 years
Wayland	Local Landfill	10,400 tons/yr.	12 years**
Wellesley	Commercial Landfill	12,000 tons/yr.	5-6 years*
Weston	Local Landfill	6,000 tons/yr.	2 1/2 years

*Estimated years left in the landfill in Plainville without the proposed resource recovery facility.

**With the liner required by DEQE.

Metropolitan Area Planning Council, April 1984.

Projected Generation

Table 2 indicates the projected generation of solid waste by MetroWest communities through 1990. The figures were derived using a simple multiplier recommended by the state's Bureau of Solid Waste Management--.6 tons per person. This approach assumes that a general multiplier will account for other waste--commercial and industrial for example--indirectly. Most communities do not provide solid waste service for commercial and industrial needs, so the quantities of waste generated by these businesses are not generally of direct concern to the host community. The numbers provided are generous for household waste, but do not predict fully the quantities of non-domestic waste which may be generated in a community.

For the MetroWest region as a whole, it may be important to ask questions about the available capacity for handling commercial and industrial waste. If all MetroWest communities are fast approaching capacity in local landfills or other solid waste facilities, the region as a whole may want to consider joint or cooperative solutions for solid waste management. This can help reduce potential impacts on host and surrounding communities, help monitor the waste management plans of proposed and expanding development, and keep the region attractive to desirable growth by assuring cost effective, long-term methods of handling waste.

In each case where the anticipated employment growth in a community is significantly larger than the expected population growth, the method of projecting solid waste generation is likely to underestimate the need for commercial waste management. The projected number of new jobs in these cases is noted.

TABLE 2

PROJECTED GENERATION OF SOLID WASTE

	1980	1985	1990
Ashland			
Population:	9,165	10,100	11,100
Tons of Waste:	5,499	6,060	6,660
.6 tons/person per year			

Table 2 (cont.)

	1980	1985	1990
Framingham			
Population:	65,113	65,100	65,100
Tons of Waste:	39,068	39,060	39,060
	plus 6,000 additional employees by 1990		
Natick			
Population:	29,461	29,500	29,500
Tons of Waste:	17,677	17,700	17,700
	plus 2,000 additional employees by 1990		
Southborough			
Population:	6,193	7,000	7,800
Tons of Waste:	3,716	4,200	4,680
Sudbury			
Population:	14,027	14,000	14,000
Tons of Waste:	8,416	8,400	8,400
	plus 800 new employees by 1990		
Wayland			
Population:	12,170	12,200	12,200
Tons of Waste:	7,302	7,320	7,320
Wellesley			
Population:	27,209	27,200	27,200
Tons of Waste:	16,325	16,320	16,320
Weston			
Population:	11,169	11,200	11,200
Tons of Waste:	6,701	6,720	6,720

Advantages and Disadvantages of Disposal Methods

The most common method of waste disposal in the MetroWest region, as in most other communities, is use of a sanitary landfill. For most communities, landfills are the only financially acceptable method of disposal. There are other advantages besides financial. Landfills can accept most types of refuse generated by a community; they can be put into operation quickly; a properly run facility does not create health hazards; and the site of a completed landfill can be used for other purposes. The major disadvantage is finding a landfill site with suitable geological and hydrological characteristics. The site must also be large enough and within reasonable hauling distances to be economically feasible.

Incineration is another method used to reduce the weight and volume of wastes prior to final disposal. Framingham and Ashland are the only 2 MetroWest communities using this method at the present time. The major advantages of incineration are: less land is required, making it possible to locate landfills near sources of waste and reducing hauling costs; the ash residue contains virtually no organic material, making it more acceptable as fill material; and the life of the landfill is extended. The disadvantages are: incinerators are expensive to construct and operate; air pollution control equipment may be required making them more expensive; and they cannot take as many types of refuse as landfills.

Resource recovery plants either burn solid wastes to extract energy in the form of steam or electricity, or process solid wastes to produce solid or liquid fuel. Currently, there is no resource recovery plant operating in the MetroWest region. The major advantages of such plants are that landfill requirements can be reduced; finding a site may be easier than for a landfill or conventional incinerator; total pollution is reduced when compared to systems using incineration for solid waste disposal and burning fossil fuels for energy; and they appear to be more economical than the two previously described methods. On the negative side, most systems will not take all types of wastes and will produce some residues making a sanitary landfill a necessity anyway; work is still being done on developing many recovery options; marketing the recovered products will have to be undertaken; large sums of investment capital are generally required; and the time between system selection and actual operation is lengthy.

Appendix D provides a summary of the potential advantages and disadvantages of solid waste processing and disposal methods, and the conditions that favor each.

Conclusions

Overall, the solid waste disposal practices in the MetroWest region appear to be reaching the upper limits of their capability to serve the current population and expected growth. Even in communities with a number of years left in their landfills, the management of solid waste is a recurring issue in need of long-term solutions. Complicating the problem are new and more stringent regulations for the operation of sanitary landfills.

In most communities, sanitary landfills, the most common means of refuse disposal, will be necessary regardless of which methods are chosen in the future. These landfills, however, must be kept in compliance with the regulations set forth in the General Laws to ensure that landfills remain an acceptable means of waste disposal. Efforts should be made to extend the life of the existing landfills in addition to selecting new sites.

The primary problem with selecting sites for new facilities is the use of a diminishing resource--suitable land. Extending the life of existing landfills means reducing the weight and volume of wastes prior to final disposal in the landfill. Recycling and conservation practices can begin to accomplish this.

In the long term, alternatives to individual landfills must be developed since the supply of usable land is already scarce. The communities of MetroWest must develop strategies to reduce the volumes of waste produced, share landfill and incinerator capabilities, and pursue resource recovery options when available.

ALTERNATIVES

Given current practices and problems, projected generation, and the advantages and disadvantages of each method of waste disposal, communities must pursue strategies to resolve local concerns over solid waste disposal capacities in the MetroWest region.

Reduction in Volumes through Recycling and Conservation

Recycling, or source separation, is the separation of certain materials from those that would otherwise end up in the waste stream to be landfilled or to be incinerated. Recycling can be cost effective because the reduction of wastes allows the landfill to last longer or lowers the fees that must be paid for every ton of refuse disposed of by commercial disposal facilities.

Besides the economic benefits, recycling offers conservation benefits. Conserving natural resources such as the metals in cans and the savings in energy (because recycling generally uses less energy than producing new goods from virgin materials) are important considerations when undertaking a comprehensive solid waste program capable of providing necessary long-term solutions.

Materials that can be recycled include newspapers, mixed papers, corrugated cardboard, high grade paper, glass, cans, bulk metal, aluminum and leaf composting. Markets are available for all these materials. Finding reliable, well paying markets is the key to a successful recycling program and should determine what materials are collected.

Management of Solid Waste

There are various problems and concerns with the disposal practices of the communities in the MetroWest region. Typical solid waste problems facing communities and some of the approaches available for solving them have been presented in an MAPC publication entitled, Some Solid Ideas on Solid Waste. These, as they relate to MetroWest communities, are included here.

1. The existing landfill is at or near capacity

   o Contract with a commercial landfill.

     Commercial landfills are available in the region, and individual communities can contract for this service. Arrangements can be made for curbside pickup, or the waste can be collected from a transfer station.

   o Contract with an intercommunity landfill.

     Some communities in the area may allow others to use their landfills. Such arrangements are made by individual cities and towns, generally with annual contract renewal. This could apply to the multicommunity use of an incinerator as well.

   o Contract with a resource recovery facility.

     In the future, communities may be able to contract with a resource recovery facility for disposal of local waste. RESCO, in Saugus, currently handles waste from metropolitan Boston communities. The 128 West Regional Resource Recovery Council's proposed project in Plainville would burn approximately 1500 tons of waste per day to produce steam which, in turn, would produce electricity. The SEMASS waste-to-energy project in Rochester will burn 1500 tons of waste per day when it begins operation. There is also a plant similar to the SEMASS project in the Haverhill-Lawrence area, and another facility under construction in North Andover (NESWC).

2. Your landfill violates DEQE regulations

   o Upgrade landfill.

     Depending on the severity of the problem, technical adjustments can be made to landfills that could stop a current threat to public health, safety, and the environment. Any such action should be discussed with engineers in DEQE regional offices.

- Close landfill.

  If the site is completely unsuitable and upgrading is prohibitively costly or technically unfeasible, the landfill should be closed and measures taken to minimize and monitor future leachate, gas generation, or other problems anticipated after closing.

The commercial landfill in Plainville, site of the proposed 128 West resource recovery project, is running out of space. Without the resource recovery facility, the landfill will reach its capacity in 5 to 6 years. With such a facility, the life of the landfill would be extended to 20 years through an estimated 90% reduction in waste. The proposed facility, however, would not be an immediate solution to those communities facing an imminent solid waste problem.

The Massachusetts Department of Environmental Management, Bureau of Solid Waste, is currently undertaking a study of solid waste problems across the state through a survey to local governments. MAPC is currently working out a program designed to complement the work undertaken by DEM for the region which will help member communities to assess realistically their options and move more quickly to manage their problems.

RECOMMENDATIONS

Although each of the impact analyses concludes with a series of alternative actions which could be taken to address or alleviate particular impacts, MAPC and CTPS recommend that the communities pursue the following specific recommendations. In summary, the communities should:

1. Form a permanent, multi-community advisory committee with members drawn from the Boards of Selectmen of each MetroWest community. The committee's duties would include promotion of coordinated growth management techniques, pursuit of comprehensive physical improvements to the region's infrastructure, and advisory review of development proposed for the MetroWest region.

2. Utilize regionwide growth management and resource protection techniques which will allow communities to protect groundwater supplies; require wastewater disposal methods which reduce peak flows; and develop access, traffic and parking requirements which reduce traffic generation.

3. Develop intercommunity agreements to facilitate the treatment and disposal of solid waste.

A more detailed discussion of the MAPC/CTPS recommendations for each issue area follows.

Intercommunity Coordination

One of the failures of past study efforts, and a potential roadblock to the implementation of the recommendations of the current study, is the absence of a permanent, collaborative implementing body which will lobby for recommended solutions, maintain intercommunity channels, and promote continued intercommunity planning. MAPC recommends that the MetroWest communities form an intercommunity advisory group to achieve these goals. The proposed advisory committee would serve as a forum for reviewing and affecting development within the region, strengthening the ability of individual communities to manage growth through cooperative action with other communities. The structure and organization of such a group may vary depending on the size, membership, duties and authority.

MAPC recommends the creation of a MetroWest Growth Management Committee whose duties would include: the development and promotion of coordinated growth management techniques for the region; coordination of regional efforts to pursue physical improvements for the region's transportation and sewer systems; development and promotion of coordinated resource protection measures and strategies; and review and advisory authority concerning development within member communities. Such a committe could

be created through an intercommunity Memorandum of Understanding (MOU). Membership should include one member of the Board of Selectmen from each community. Ultimately, the advisory committee may want to pursue legislative authorization as a means of increasing its visibility, legitimacy, and authority. In the short term, however, a sufficiently empowered committee may be formed more quickly through an intercommunity MOU. The optimum situation would be one in which the technical work produced by MAPC, CTPS, and the Working Committee is used as the starting point for the newly formed inter-town committee. An MOU suitable for use by the MetroWest communities follows this section.

Transportation

From the findings presented in the impact analysis it is obvious that the area's roadways will fail to carry effectively the existing and anticipated traffic by 1990, especially along the Route 9/30 corridor. However, from the assessment of the solutions, it can be concluded that the following alternative schemes offer promising results:

1. Direct capacity additions to E-W roadways through widening, grade separation and intersection improvements.

2. Intersection improvements to the N-S roadways.

3. Some form of land-use control for the whole area.

Although the nature of this analysis does not allow the description of specific design improvements or combination of improvements, there are several recommendations which can be made:

- Routes 9 and 30 warrant a detailed corridor planning study with the boundaries of the study area extending beyond Southborough to the west and Wellesley to the east. The effects of north-south travel to the corridor should also be examined.

- A list of area projects which have either been dropped or included in the 2-5 year element of the TIP (Transportation Improvement Program) was previously presented to the Committee. It is recommended that the towns take the necessary actions to revive or expedite the construction of these projects. Some of them could provide a short term solution to the traffic problems identified in this study. These lists are contained in Appendix E.

- Towns should consider instituting some control on their growth. Transportation research shows that additional facility capacity usually draws more trips to the area. Unless the reasons for additional automobile trips are restricted, a balance between supply (facilities) and demand (trips) will not be achieved.

- o Ridesharing, flexible or staggered work hours, and transit usage should be encouraged.

- o Existing and new developers should be requested to participate in the financing of any roadway improvements required according to their contribution to traffic impact. Participation could also take the form of setting aside rights-of-way for improvements.

Water Supply

MAPC recommends that all MetroWest communities develop techniques to protect their groundwater supplies. Of the eight MetroWest communities, Natick, Sudbury, and Weston are currently pursuing or have in effect groundwater protection measures. Weston has recently completed a hydrogeologic and aquifer mapping study, Sudbury has proposed aquifer protection zoning districts, and Natick has water resource protection district zoning in effect. Several communities are also seeking additional supplies. The need to protect, and the benefits from protecting, groundwater are well-documented. The available measures are described in the alternatives section of the water supply impacts analysis and in its appendix. The various regulatory and non-regulatory techniques either create local authority or draw on established regulatory powers allowing communities to control development in watersheds and recharge areas and influence drainage methods and sites.

A complete description of the steps necessary to plan, develop, and implement a local groundwater protection program may be found in MAPC's publication Groundwater Protection: A Guide for Communities. The Council has an ongoing program to assist communities in developing protection programs. Additional information concerning alternative drainage methods and techniques for improving groundwater recharge is available in MAPC's report Runoff and Recharge.

Wastewater Disposal

The Council recommends that all MetroWest communities reduce the volumes of wastewater produced, and especially the peak volumes of wastewater disposed of through the sewer systems. Local regulatory authority should be used to require alternative disposal methods when appropriate, flow equalization techniques such as holding tanks, and water conservation methods to reduce wastewater generation.

In addition, renewed efforts should be made to reduce the impact of infiltration and inflow by reducing inappropriate sewer connections and continuing maintenance.

The Council also recommends that those communities served by the MDC support the reconstruction of the Wellesley Extension Sewer and the construction of the Framingham Extension Relief Sewer, and work with the MDC toward an acceptable alignment.

Solid Waste

MAPC recommends that the MetroWest communities reduce the volumes of solid waste generated for disposal at local landfills. Local programs encouraging recycling, such as curbside pickup in the larger communities of Natick and Framingham, should reduce the volumes requiring disposal.

Cooperative arrangements among communities will also allow the subregion's landfill resources to last longer. For example, excess incinerator capacity in Framingham should be used to reduce the volume of material disposed of in other landfills.

Growth Management/Resource Protection Techniques

There are a variety of techniques and regulations available to communities that will enable them to control growth and its impacts and protect natural resources. The measures range from those that control growth directly such as planned unit development, cluster, and phased growth zoning bylaws; those that control the impacts of growth, such as site plan review, local curb cut and sewer connection permits; and those designed to protect specific resources from adverse impacts such as groundwater protection measures. Depending on the type of methods used, a community can control the use, intensity, location, and impacts associated with new development.

It is clear from memos outlining the expected impacts of growth on the water, sewer, and transportation systems that the MetroWest region must consider physical improvements in order to handle the expected growth. Sewer and roadway construction, for example, are necessary to meet existing needs. The MetroWest region cannot ,however, rely on physical solutions to alleviate all the impacts of growth. Measures which enable communities to review, guide, or control development and its impacts must continue to be developed and implemented. The MetroWest area should have regionwide, compatible land use controls and resource protection measures.

Among the measures which could be implemented in each MetroWest community, site plan review is useful, given current and expected conditions. MAPC recommends this as an example of the measures and authority available to communities to control growth and its impacts.

Five of the 8 MetroWest communities have adequate site plan review bylaws. Virtually all new development or expansion of existing uses, excluding single family residential, is subject to site plan review, and the factors upon which projects will be reviewed are specifically listed. The 3 remaining communities where site plan review requirements appear to be inadequate include Framingham and Natick, where significant development may occur with little or no review. In Natick, the review process does not include some commercial use categories and locations.

In Framingham, only development within a limited geographic area is subject to review. The third community, Ashland, has a site plan review provision which requires review of most projects, but it does not clearly list the factors upon which plans will be reviewed.

The need for improved site plan review processes in some areas of MetroWest is well known, and in fact Framingham and Natick are in the process of developing new bylaws. MAPC believes that it is crucial for all the communities to develop and implement comparable land use controls; and a strong site plan review bylaw is basic to controlling growth and its impacts. Site plan review provisions enable a community to exert some control over development, whether it is new development in a growing community, or redevelopment in an established community.

As important as a strongly written bylaw, is a knowledgeable, committed special permit-granting authority. The local board charged with enforcing site plan review provisions must have a clear understanding of, and commitment to, the community's goals regarding growth control. When properly implemented and coupled with town policies and departmental regulations, site plan review will provide the authority to review and modify growth so that communities may enjoy growth benefits while limiting its adverse impacts. A model site plan review bylaw is included in Appendix F.

MEMORANDUM OF AGREEMENT
by and among the towns of
ASHLAND, FRAMINGHAM, NATICK, SOUTHBOROUGH
SUDBURY, WAYLAND, WELLESLEY, AND WESTON
and the
METROPOLITAN AREA PLANNING COUNCIL

This Memorandum is agreed to by and among the eight towns named above, referred to as MetroWest, and the Metropolitan Area Planning Council, (MAPC), for the purpose of establishing an intercommunity growth management committee.

This Committee is being established because the towns, together with MAPC:

- Perceive the need for, and support the concept of, cooperative planning in order to meet the needs of their citizens.

- Wish to retain the characteristics and physical attributes which distinguish their region as an attractive and desirable place to live and work.

- Believe that a mechanism for maintaining communication, cooperation and implementation of goals is necessary,

and because the region is increasingly affected by the impacts of growth as evidenced by increases in traffic volumes, water consumption and generation of solid waste and wastewater.

The eight communities and MAPC therefore, agree as follows:

SECTION I. CREATION OF ADVISORY COMMITTEE ON GROWTH MANAGEMENT

The MetroWest communities and MAPC shall form a permanent committee to be known as the MetroWest Growth Management Committee (the "Committee") consisting of one member of each town's Board of Selectmen, one member of each town's Planning Board, selected by their respective boards, and the Executive Director of MAPC or a designee. Each town and the MAPC shall have one vote; if the two members from a town disagree, the vote of the Board of Selectmen member shall be the official vote. The Committee may invite any other person or organization concerned with MetroWest growth issues to become an associate member and to participate in committee deliberations, but not to vote. The Committee may be expanded by admitting to full membership any abutting city or town by a two-thirds affirmative vote of the Committee.

SECTION II. PURPOSE OF GROWTH MANAGEMENT COMMITTEE

The purpose of the Committee shall be to foster joint and cooperative action concerning growth and development within the MetroWest region.

The Committee shall have the following functions and responsibilities:

- to assist and advise all agencies, boards and authorities in their policies and actions affecting growth and development within the MetroWest region,

- to develop and promote coordinated plans, programs and techniques of growth management and resource-protection for all member communities,

- to work for the implementation of the acceptable recommendations of the MAPC MetroWest report,

- to coordinate efforts to pursue physical improvements to the region's infrastructure,

- to review and comment on proposed significant developments occurring within member communities, and

- to assume such other duties as the Committee believes necessary to carry out its purpose or as may be assigned to it by member towns.

The Committee shall not make binding decisions or commitments, act on behalf or impose any requirements on member towns or MAPC, except as authorized by them in accordance with applicable legal requirements.

SECTION III. METHOD OF OPERATION OF GROWTH MANAGEMENT COMMITTEE

The Committee shall, at its first meeting, adopt rules governing its decision-making process, frequency of meetings and general operations. Adoption of these rules shall require an affirmative two thirds vote.

The Selectmen or Planning Board member may appoint as an alternate another member of his/her respective board.

The MAPC may provide staff assistance to the Committee (coordinate meetings, keep records and correspondence, etc.), act as executive secretary to the Committee, and furnish professional assistance to the Committee or its member communities.

SECTION IV. ROLE OF GROWTH MANAGEMENT COMMITTEE

The role of the Committee is to provide advice and guidance to the MetroWest communities in the area of physical development and, as may be authorized by member towns, seek assistance and grants from state, federal, and other sources. All eight towns and MAPC support the concept of coordinated development within MetroWest and each assures that:

- The MAPC shall send the Committee copies of all environmental, intergovernmental (A-95), state capital facilities and other statutory review notices for projects in the MetroWest area.

- Each Board of Selectmen agrees to notify every relevant local Board (e.g. Board of Health, Board of Appeals, Conservation Commission, etc.) of the existence and objectives of the Committee.

- Each Planning Board, in addition to sending notices of zoning amendments to abutting towns and MAPC as required by state law, agrees to send such notices to all other MetroWest towns.

- Each Board of Selectmen agrees to send copies of all plans, programs, assessments or recommendations of the Committee to the relevant town boards and officials.

- members of all relevant boards and officials of the eight towns and the MAPC will be requested to furnish the Committee with information, at the earliest possible time, about any proposed major or significant development projects which meets any of the following definitions:

  a. institutional, commercial or industrial construction in excess of 50,000 square feet total floor area or adding 100 parking spaces;

  b. residential development in excess of 50 one- or two-family dwellings, or 50 apartment or condominium dwelling units;

  c. any development on a lot, other than a one- or two-family residence, or any way or parking lot within 400 feet of the border of another MetroWest community or of a numbered highway;

  d. any other development which the local board or official or the Committee believes to be of more than local significance.

The Committee may request additional information, or notice of action, or may recommend measures to minimize or mitigate foreseeable significant impacts of any proposal brought to its attention.

SECTION V. EVALUATION OF THE GROWTH MANAGEMENT COMMITTEE

One year after the execution of this agreement the signatories shall review and evaluate the performance of the Committee and make recommendations concerning its future operation.

SECTION VI: AMENDMENTS OF MEMORANDUM OF AGREEMENT

This Memorandum of Agreement may be amended or cancelled at any time by mutual agreement of all members towns, and any member town may withdraw from participation in the Committee upon two months' written notice signed by both community representatives or their appointing boards.

IN WITNESS WHEREOF, the eight towns and MAPC have executed this Memorandum of Agreement on their behalf by their duly authorized representatives.

ASHLAND BOARD OF SELECTMEN	ASHLAND PLANNING BOARD
FRAMINGHAM BOARD OF SELECTMEN	FRAMINGHAM PLANNING BOARD
NATICK BOARD OF SELECTMEN	NATICK PLANNING BOARD
SOUTHBOROUGH BOARD OF SELECTMEN	SOUTHBOROUGH PLANNING BOARD
SUDBURY BOARD OF SELECTMEN	SUDBURY PLANNING BOARD
WAYLAND BOARD OF SELECTMEN	WAYLAND PLANNING BOARD
WELLESLEY BOARD OF SELECTMEN	WELLESLEY PLANNING BOARD
WESTON BOARD OF SELECTMEN	WESTON PLANNING BOARD
METROPOLITAN AREA PLANNING COUNCIL	DATE

APPENDIX A

MetroWest Proposed Development Inventory

Ashland

1. Ledgemere Country: mixed use (residential, commercial, light industry); 712 condos, 50 single family, 250,000 sq. ft. commercial, 200,000 sq. ft. light industry; 700 employees; Eliot Street and Route 126.

2. Ashland Commons: residential; 96 units (47-1 bedroom, 33-2 bedroom, 12-3 bedroom, 4-4 bedroom); between Union Street and Metro Avenue.

3. Unnamed: residential, 126 units; Route 135 next to Ashland Commons.

Totals

1. 984 additional housing units

2. 700 additional employees

Framingham

1. Bullard, Porter and Concord Buildings: retail and office; 57,000 sq. ft. (28,500 retail, 28,500 office); 170 employees; corner of Waverly Street and Hollis Street, and corner of Concord Street and Franklin Street.

2. Framingham Union Hospital Expansion and medical condominiums, Lincoln Medical Center: office, 143,000 sq. ft.; 570 employees; Lincoln Street and Evergreen Street.

3. Chateau DeVille: commercial; 10,000 sq. ft.; 20 employees; Route 9.

4. West Park: office; 417,000 sq. ft.; 1,650 employees; Route 9 (south side) at Natick town line.

5. Shopper's World Expansion: retail, office and hotel; 1,600,000 sq. ft. (1.1 million retail, 500,000 office/hotel); 2,500 additional employees; Route 9.

6. Point West Place: office and storage; 118,000 sq. ft. 425 employees; Speen Street and Cochituate Road.

7. Centros House: office 138,500 sq. ft.; 550 employees; Old Connecticut Path at Speen Street.

8. Racquetball Club conversion: office and garage; 47,00 sq. ft.; 100 employees: Speen Street

9. YMCA expansion: Old Connecticut Path.

10. Progressive Development: office; 35,000 sq. ft.; 140 employees; Route 9 and Stony Brook Road.

11. Sheraton Tara Hotel expansion: commercial; 19,000 sq. ft.; 30 employees; Route 9 near Mass Pike interchange.

12. Alloy Computer Products: office 78,000 sq. ft.; 80 employees; Pennsylvania Avenue.

13. Integrated Genetics: office, storage, research; 37,000 sq. ft.; 60 employees; New York Avenue.

14. Frass Associates: research and development; 64,000 sq. ft.; 195 employees Route 9 (Bekins Moving site).

15. First National Complex: office; 1,000,000 sq. ft; 4,200 employees; Route 9 at Southborough town line.

16. Consolidated Group Building: office; 40,000 sq. ft.; 160 employees; Pleasant Street.

17. Subdivisions: residential; 311 lots (single family); Pleasant Street, Carter Drive, Edmands Road, Brook Street, and Belknap Road.

Totals

1. 311 additional residential lots

2. 10,850 additional employees.

Natick

1. Apple Hill: office and commercial; 470,000 sq. ft. (380,000 office, 90,000 retail); 1,700 employees; Route 9 (south side) and Wheeler Lane.

2. Natick Executive Park expansion: office; 180,00 sq. ft.; 720 additional employees; Route 9 (north side).

3. Unnamed: office; 30,000 sq. ft.; 120 employees; Route 9 at Route 27.

4. Holiday Inn: commercial; 300,000 sq. ft.; 600 employees; Route 9 near Framingham border.

5. Former G. E. building: office and retail; 62,500 sq. ft; 250 employees; Speen Street.

6. Unnamed: office; 15,000 sq. ft.; 60 employees; Route 135 near Framingham border.

7. Natick Mall expansion: retail; 250,000 sq. ft.; 250 additional employees, Route 9.

8. Medical office condominiums: office; 17,600 sq. ft.; 70 employees; Union Street.

9. Coolidge Jr. High conversion: residential; 53 units (45 elderly, 8 family); Cottage Street

10. Subdivisions: residential; 267 units; Hunnewell, Hopewell Farm and Captain Tom's Hill.

Totals:

1. 320 new residential units

2. 3,520 additional employees

Southborough

1. Southborough Office Building: office; 72,000 sq. ft. 290 employees; Route 9 (north side) and Parkerville Road.

2. Southborough Office Park: office; 240,000 sq. ft.; 960 employees; Route 9 (south side) and White Bagley Road.

Totals

1. no significant residential growth

2. 1,250 additional employees

Sudbury

1. Mill Brook Park Phase II: office; 28,000 sq. ft.; 112 employees; Route 20 (north side) and Massassoit Avenue.

2. Sudbury Farms: retail/commercial; 80,000 sq. ft.; 160 employees; Route 20 (south side) at Union Avenue.

3. Unnamed: office; 17,500 sq. ft.; 80 employees; Codjer Lane.

4. Unnamed: office; 8,000 sq. ft.; 32 employees; Codjer Lane at Union Avenue.

5. Unnamed: office; 8,000 sq. ft.; 32 employees; Route 20.

6. Star Market expansion: retail/commercial; 23,000 sq. ft; 45 employees; Route 20.

7. Longfellow Glen: residential; 140 units (multi-family); Route 20 (south side at Robbins Road).

Totals:

1. 140 new residential units

2. 460 additional employees

Wayland

1. Mainstone Farm Condominiums: residential; 435 units; Rice Road.

Wellesley

1. Wellesley Office Park, Building VII: office; 72,000 sq. ft.; 100 employees; Williams Street.

2. Sun Life Office Park, Building III: office; 119,000 sq. ft.; 400 employees; Route 9 (south side) at Route 128.

3. 366 Washington Street: office; 30,000 sq. ft.; 60 employees.

Totals:

1. no significant residential growth

2. 560 additional employees

Weston

None

APPENDIX B

Means of Travel to Work

Table 2.2.1 shows that travel by MetroWest residents is predominantly automobile oriented. With the exception of Wellesley, which has a high student population, automobile usage ranges between 80% and 94% in other communities. The average mode split between private automobile and public transportation is a low of 96/4.

From Table 2.2.2, the majority of automobile users (81%) drive alone to work. It is also interesting to notice that there is no major variation in the distribution of carpool size and vehicle occupancy among MetroWest communities. The average vehicle occupancy for the study is 1.11 persons/vehicle.

Dominance of the automobile as a mode of travel in the area is supported by Table 2.2.3. Only 4% of the households in the study area do not own a vehicle, while 67% of the households own at least two vehicles.

Finally, Table 2.2.4 shows the distribution of the duration of the work trip with an average of about 20 minutes.

Traffic Counts

The State Department of Public Works and local authorities collect traffic counts at critical points of the highway network. Counts are taken either continually (continuous control stations), at specified intervals of time (14 days per month or once yearly), or for special purposes. Their main usage is in the monitoring of the operation of the traffic network.

There are 6 control count stations, counted 14 days per month, in MetroWest. Table 2.4.1 shows the Average Daily Traffic volumes at these locations.

Locations of other traffic counts are shown in Figure 2.4.1. The majority of the counts exist in the central communities of Southborough, Framingham, Natick and Wellesley. The rest of the communities lack sufficient coverage of traffic monitoring. The Average Daily Traffic (ADT) for 1980 is shown in Figure 2.4.2.

Analysis Methodology

The methodology which transportation analysts use to identify the travel patterns on the highway network is the so-called four-step transportation planning process. Basically, the technique is a modeling (simulation) of reality based on an abstraction of the actual highway network.

Means of Travel To Work	Ashland		Framingham		Natick		Southborough		Sudbury		Wayland		Wellelsey		Weston	
	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total
Private Vehicle	4,749	93%	30,312	89%	13,286	87%	2,826	94%	6,075	92%	5,630	93%	8,896	71%	4,197	80%
Public Transportation	100	2%	1,172	3%	765	5%	24	1%	170	2%	161	3%	1,373	11%	334	6%
Walked Only	198	4%	2,132	6%	848	6%	108	3%	107	2%	66	1%	1,500	12%	393	8%
Other Means	20	0%	154	1%	124	1%	21	1%	67	1%	74	1%	158	1%	38	1%
Worked At Home	66	1%	424	1%	213	1%	41	1%	193	3%	143	2%	528	4%	236	5%
Total Workers	5,133		34,194		15,236		3,020		6,612		6,074		12,455		5,218	

SOURCE: U.S. Census 1980.

TABLE 2.2.1

NUMBER OF WORKERS AND THEIR DISTRIBUTION BY MEANS OF TRAVEL TO WORK

Level of Vehicle Occupancy	Ashland		Framingham		Natick		Southborough		Sudbury		Wayland		Wellelsey		Weston	
	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total
Drive Alone	3,742	79%	24,141	80%	10,622	80%	2,314	82%	4,863	80%	4,667	83%	7,374	83%	3,535	84%
2-Person Carpool	791	17%	4,656	15%	2,108	16%	395	14%	908	15%	734	13%	1,165	13%	525	12%
3-Person Carpool	148	3%	956	3%	389	3%	79	3%	223	4%	164	3%	207	2%	67	2%
4-Person Carpool	51	1%	352	1%	112	1%	19	1%	58	1%	13	0%	100	1%	32	1%
5-Person or More Carpool	17	0%	207	1%	55	0%	19	1%	23	0%	52	1%	50	1%	38	1%
Total Workers Using Private Vehicle	4,749		30,312		13,286		2,826		6,075		5,630		8,896		4,197	
Number of Workers Per Private Vehicle	1.13		1.13		1.12		1.11		1.12		1.10		1.10		1.09	

SOURCE: U.S. Census 1980.

TABLE 2.2.2

NUMBER OF WORKERS AND THEIR DISTRIBUTION BY VEHICLE OCCUPANCY LEVEL

Number of Vehicles	Ashland	Framingham	Natick	Southborough	Sudbury	Wayland	Wellesley	Weston
0	3%	8%	7%	5%	1%	2%	5%	2%
1	37%	44%	38%	25%	18%	23%	33%	17%
2	44%	37%	40%	48%	61%	53%	48%	56%
3 or more	16%	11%	15%	22%	20%	22%	14%	25%

SOURCE: U.S. Census 1980.

TABLE 2.2.3

DISTRIBUTION OF HOUSEHOLDS BY VEHICLE AVAILABILITY

Travel Time to Work in Minutes	Ashland		Framingham		Natick		Southborough		Sudbury		Wayland		Wellelsey		Weston	
	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total	Number of Workers	% of Total
less than 5	97	2%	1,108	3%	353	2%	205	7%	168	3%	129	2%	691	6%	322	6%
5 to 9	544	1%	4,162	12%	2,459	16%	421	14%	738	11%	546	9%	1,838	16%	396	8%
10 to 14	1,021	20%	6,942	20%	3,314	22%	415	14%	878	13%	1,014	17%	1,704	14%	787	16%
15 to 19	1,061	21%	5,215	15%	2,160	14%	383	13%	673	10%	805	13%	1,487	12%	570	11%
20 to 29	1,032	20%	6,047	18%	2,265	15%	556	19%	1,271	19%	1,402	23%	2,109	18%	1,019	21%
30 to 44	731	14%	6,947	20%	2,969	20%	661	22%	1,799	28%	1,488	25%	2,558	22%	1,416	29%
45 to 59	417	8%	2,475	7%	942	6%	197	7%	555	8%	442	7%	958	8%	256	5%
60 or more	200	4%	1,204	4%	556	4%	109	4%	452	7%	211	3%	511	4%	176	4%
Mean	21.3 minutes		21.5 minutes		20.5 minutes		21.8 minutes		26.1 minutes		23.5 minutes		22.2 minutes		22.6 minutes	

SOURCE: U.S. Census 1980.

TABLE 2.2.4

TRAVEL TIME TO WORK BY TOWN

Town	Route	Location	ADT 1970	ADT 1980
Ashland	135	At the Ashland T.L.	7,950	9,233
Framingham	9	West of the Penn. Central R.R.	31,300	31,255
Natick	27	At the Sherborn T.L.	4,350	5,707
Southborough	I-495	North of Rte. 30	22,250	25,835
Sudbury	117	East of the Maynard T.L.	5,400	7,308
Weston	20	East of the Wayland T.L.	17,950	19,387

SOURCE: Transportation Facts for the Metropolitan Boston Region, CTPS.

TABLE 2.4.1

LOCATION AND VOLUMES AT CONTROL COUNT STATIONS IN METRO-WEST

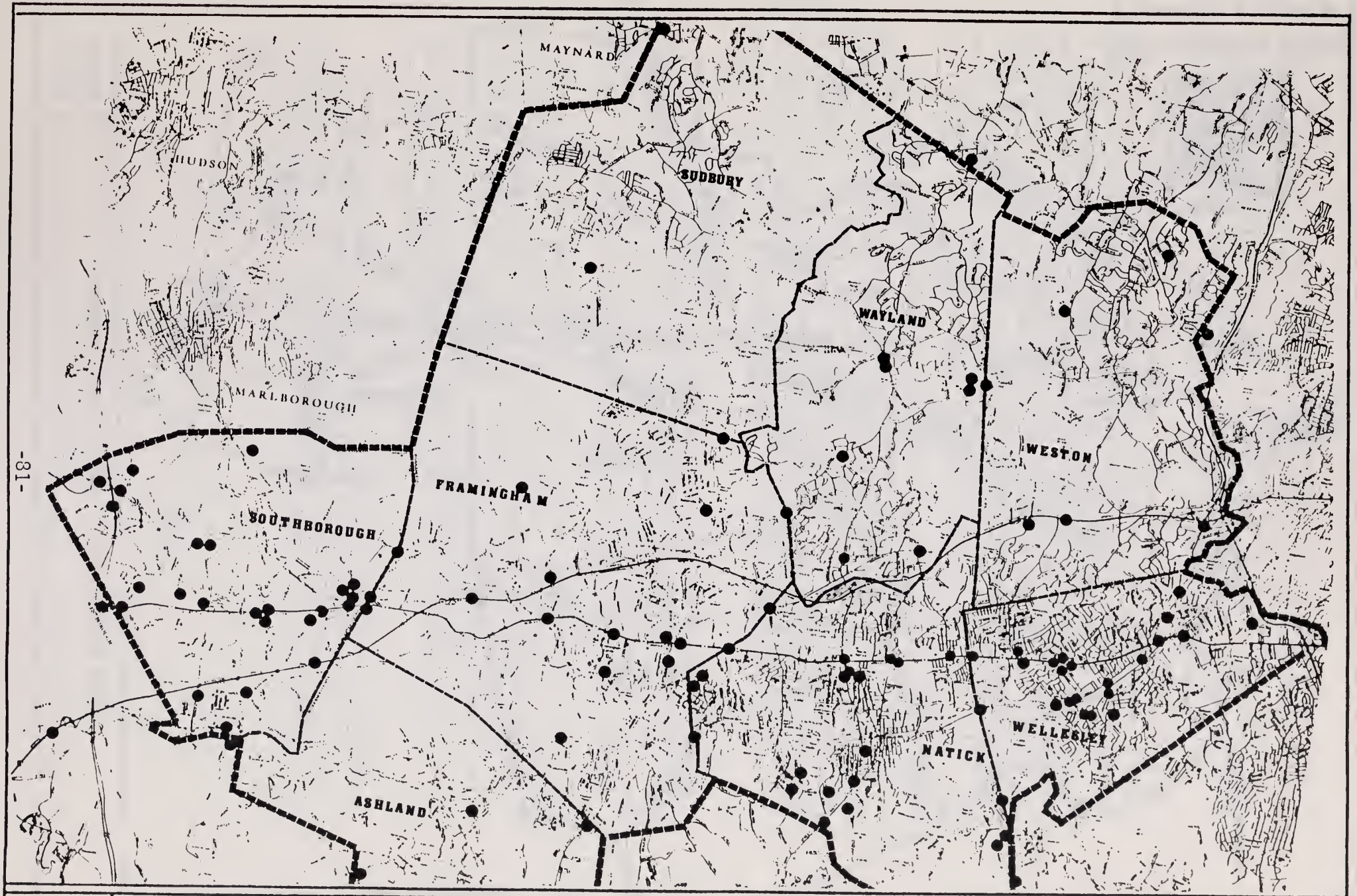


FIGURE 2.4.1

TRAFFIC COUNT LOCATIONS IN METRO-WEST

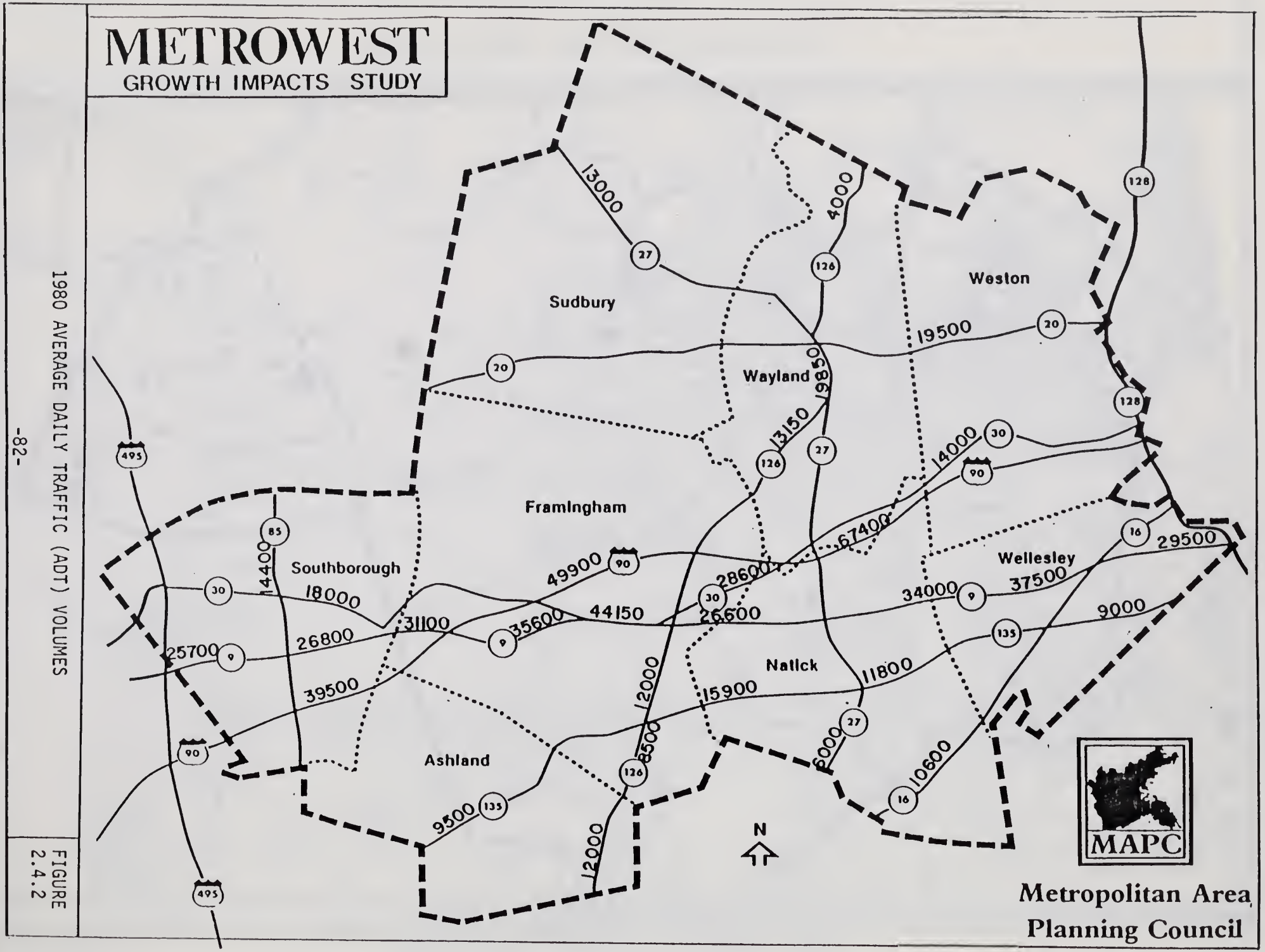

METROWEST
GROWTH IMPACTS STUDY
1980 AVERAGE DAILY TRAFFIC (ADT) VOLUMES
Sudbury
Weston
Wayland
Framingham
Southborough
Natick
Ashland
Wellesley
13000
4000
19500
19850
13150
14000
67400
29500
49900
28600
14400
18000
31100
35600
44150
26600
34000
37500
25700
26800
9000
39500
12000
15900
11800
8500
6000
10600
9500
12000
N
MAPC
Metropolitan Area
Planning Council

FIGURE 2.4.2

Very briefly, the process covers the elements of trip generation (zonal attractions and productions), trip distribution (trip interchanges between zones), mode choice (separation of trips by means of travel), and trip assignment (loading of trips on the network.) The four steps are executed twice: for the base year and the forecast year for each of the alternatives (future transportation/land use scenarios).

In the MetroWest case, the first step was to identify the extent of the study area's impact in terms of exchange of work or shopping trips. Given the central location of MetroWest and its intensity of development, it was decided that the whole state of Massachusetts should be investigated for trip exchanges and eventual traffic volume loadings on MetroWest's highway network. For this purpose, the area surrounding the eight study area communities was divided into 16 traffic districts. The criteria for the division include population homogenity, district size, and spatial allocation of highway facilities. The traffic analysis districts for the MetroWest Study are shown in Figure 3.1.1.

Next, the highway network of MetroWest was simulated on an appropriately sized map. Roadway sections were identified by link numbers. The network includes all interstate, state, and major urban arterials in the area. The constructed network consists of 126 links and is connected with the rest of the state network through a number of points on the periphery of the study area called external traffic stations. When the external or through trips are loaded on the highway network, the assumption is made that they cross the study area boundaries at the external stations.

The 1980 U.S. Census work trips were used for the analysis. These were factored appropriately to reflect other trip purposes. Since the origin and destination of each trip is known from the census, the assumption was made that all trip purposes exhibit the same distribution patterns, eliminating the formal trip distribution step of the process.

Next, from the total number of daily person trips calculated in the above manner, the vehicle trips were isolated. This required taking into account the mode split in the area and the average vehicle occupancy. At the end of the process, the vehicle volumes from or to each of the external 16 districts and each of the internal 8 MetroWest communities were available. In a similar way, the trip tables for through, inter-zonal (between MetroWest communities) and intra-zonal (within MetroWest communities) were constructed.

Traffic assignment is the process by which the vehicle volumes are loaded onto the highway network. In order to simulate real travel, assumptions were made regarding the point where an external trip will cross the study area boundary and the roadway path it would take to reach its final destination.

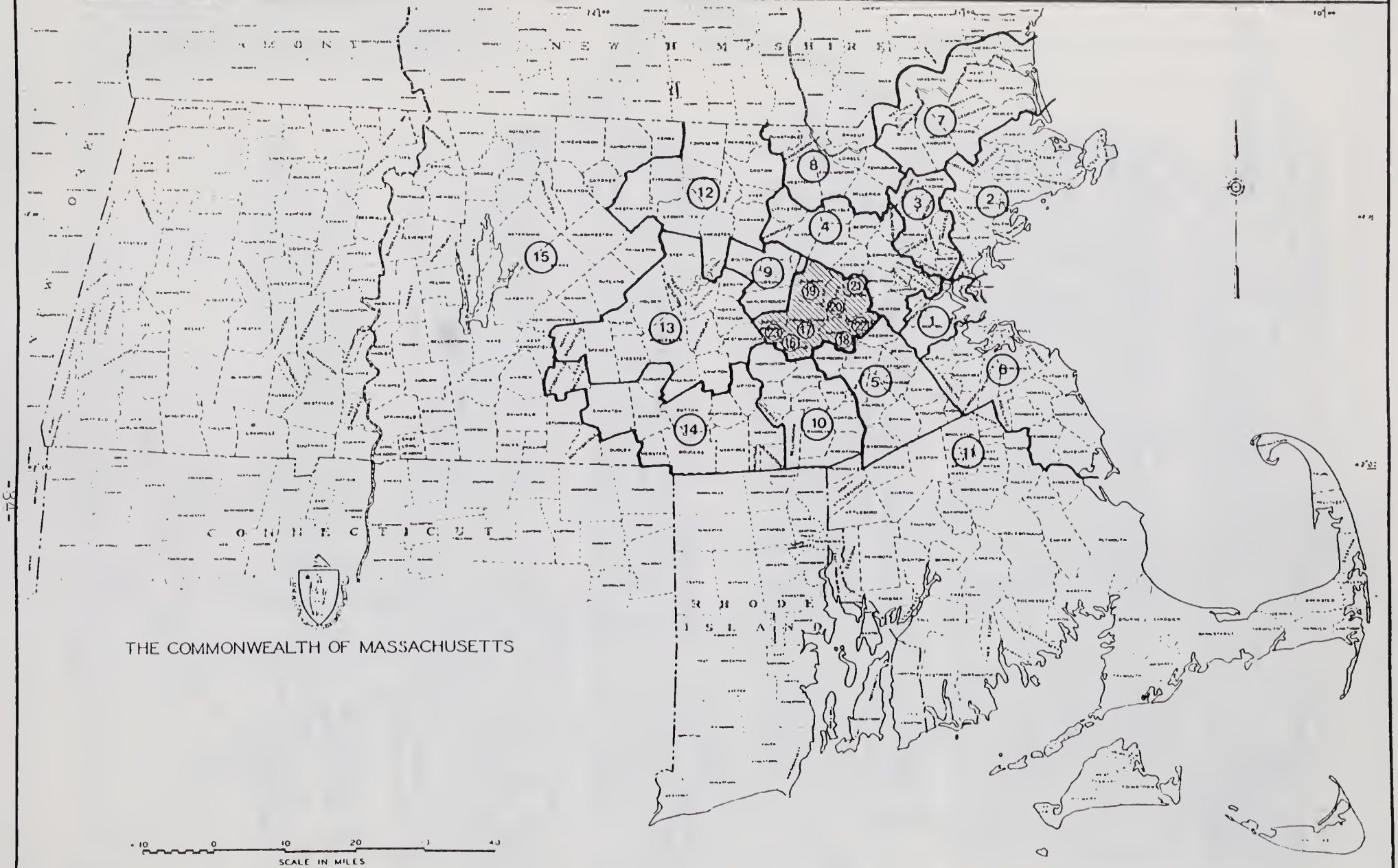


FIGURE 3.1.1

TRAFFIC ANALYSIS DISTRICTS

Each origin/destination pair was assigned to a traffic path. Several factors were taken into account to identify the most direct path:

- the particular type and duration of the trips being loaded
- the functional class of the facilities on the path and also the capacity of the roadway
- special knowledge of the area, e.g., bottleneck intersections, short-cuts, etc.

After all trip types were assigned on the 126 links of the network, the total volumes were compared to actual volumes wherever available, and the differences were found satisfactory. This completed the base year (1980) traffic assignment.

APPENDIX C

Groundwater Protection Techniques

To develop an effective program to protect groundwater, techniques should be selected on the basis of threats to the aquifer(s), the appropriate degree of protection required, and the level of protection afforded by the particular technique. An effective program will probably involve a combination of regulatory and non-regulatory measures.

Regulatory Techniques: Zoning

Once areas significant to groundwater water resources are identified and the community's zoning examined for conflicts with groundwater protection, the community should consider zoning amendments. Where current zoning allows development that may threaten groundwater by loss of recharge or discharge of pollutants, amendments should be made. For instance, areas zoned industrial may be changed to "low density residential". Alternatively, the uses within an industrial district can be changed to prohibit those specifically associated with pollutant generation. Another approach is to amend the area requirements in a zoning district. Open-space requirements can be increased so that no more than 50% or less of the land is developed. Some towns allow no more than 20% lot coverage in industrial zones. Limiting lot coverage helps to maintain the functioning of groundwater recharge areas.

Area requirements also can be changed to reduce the amount of impervious cover in non-residential districts by increasing:

--minimum landscaping requirements
--the percentage of small-car parking spaces
--setback requirements from parking areas, streets, and property lines and
--landscaping requirements in parking areas.

Some towns have considered requiring the use of pervious pavement to increase recharge. In residential districts, minimum lot size can be increased to one or two acres, or maximum lot coverage can be limited to 10%.

In order to establish an aquifer protection district, aquifers and recharge areas must be delineated precisely. This is best accomplished by a detailed hydrogeologic study of the town. Some towns have opted to include only cones of depression (or cones of influence) of municipal wells in the aquifer protected district. Delineation of cones of depression requires prolonged pumping of the supply well and numerous observation well readings.

In seeking to protect groundwater, the emphasis is not upon preventing all development--as may be the case in flood prone areas--or upon segregating certain types of development--as is usually the case in traditional zoning. Rather, the thrust of the law is to prevent certain types of polluting substances from getting into the groundwater and to reduce coverage of the ground that prevents water recharge. For these purposes, there is no inherent virtue in single family houses; a small warehouse without a parking lot or septic system might actually do less harm. Thus, the bylaw concentrates on prohibiting use and storage of contaminants, and on limiting lot coverage. In this way, it resembles a watershed protection bylaw.

If a community does not have the benefit of a local study which defines aquifer and recharge areas but needs to protect its groundwater, it may be wise to consider a watershed protection district. This should be considered only if and when watersheds have been carefully delineated and checked with USGS, and watershed areas correspond to groundwater drainage areas (according to USGS Hydrologic Atlas). If there is documented recharge of groundwater by surface water, such as induced infiltration, then a watershed protection district is more strongly justified.

A watershed protection district would include the aquifer's entire drainage area, not just the primary recharge areas. Therefore, it covers a broader area and should be slightly more general than an aquifer protection district. One advantage of a watershed protection district is that the boundary is easier to define than that of an aquifer protection district. Appeals on applicability will be less frequent and less costly.

The purpose of site plan review is to control the design of projects not under subdivision control. Many major developments are not subdivisions, either because the land remains one parcel, as with a large apartment complex, or because the newly created lots have frontage on an existing public way, as may occur with a shopping center or industrial park.

Although a site plan review bylaw often is administered by special permit, it cannot address what uses will be permitted in the zoning district. Therefore, the granting authority will be considering only specific design factors. The impacts of the development on surface water, groundwater, water supply, and other environmental concerns can be assessed under site plan review. It takes more factors into account than a planning board may consider when reviewing roadways, drainage, and utilities under the Subdivision Act, and unlike subdivision control, does not give the reviewing authority the power to refuse approval if the project meets all of the standards under the bylaw. So it is important to require information adequate to determine likely impacts and to make certain the design shows necessary mitigation measures to meet the criteria for approval.

Regulatory Techniques: Non-Zoning

Although zoning may effectively protect groundwater it is often necessary to adopt bylaws or regulations. Bylaws to regulate specific sources of pollution--such as underground fuel, hazardous materials, and road salt--are direct means of protecting groundwater from contamination while allowing permitted uses in the underlying district.

Orders of Conditions (Wetlands Protection Act)

In general, wetlands that overlie aquifers or border surface waters from which wells induce infiltration are likely to be significant for recharge and for removing pollutants. They should be protected. However, most wetlands are groundwater discharge areas, so it cannot be assumed automatically that all wetlands are equally significant to groundwater.

Under the Wetlands Protection Act (MGL Chapter 131, Section 40), local conservation commissions have jurisdiction over filling, dredging, removal, and alteration of wetlands. Conservation commissions issue a permit, called an "Order of Conditions," for activities that alter wetland areas, and these orders may regulate the activity for the purpose of protecting groundwater. A commission must first ascertain if the particular wetland is significant to groundwater.

When the protection of groundwater has been identified as a significant statutory interest, the following protection measures may be required in the order of conditions:

a. No increased runoff from the site up to and including the 100-year storm, in order to preserve the groundwater-recharge capability of the site.

b. Development and implementation of an erosion and sedimentation control program to avoid siltation of wetlands and the resultant "sealing-off" of wetlands from underlying aquifers.

c. Designing drainage structures to reduce runoff. Such designs include leaching-type catch basins, perforated drainage pipes (laid in crushed stone), and construction of retention areas.

d. No filling of wetlands without 100% on site compensatory flood storage to provide equivalent recharge and pollution attenuation functions.

e. Impervious surfaces should be reduced. Landscaping, planted buffer strips, and open space should be encouraged.

f. Roof drains should terminate in dry wells designed to help groundwater recharge while avoiding backup into basements.

g. Pollution control devices, such as grease traps and oil/gas separators, should be installed where appropriate, and should be maintained to prevent the discharge of gasoline, oil and grease from vehicles into the groundwater.

Other conditions may be imposed when deemed necessary, depending on the specific site characteristics and type of development.

Subdivision Regulations

Planning boards, in evaluating proposed subdivisions, are given the power (and have the duty) to adopt regulations governing design and construction of ways, drainage, and utilities. Within these limitations, planning board regulations may be effective in protecting water

resources, including groundwater. For example, they may require that the drainage in an aquifer or recharge area be designed such that runoff from the site is not increased. In areas sensitive to pollution, such as drinking watersheds, aquifers, and lakeshores, erosion and sedimentation control or oil traps may be required in catch basins. Regulations may require that the applicant supply data on soils and runoff; they may limit removal or disturbance of groundcover.

Communities should consider the use of open drainage systems, especially in developing areas with residential zoning of one acre or more or large open areas of land.

Underground-Fuel-Storage Bylaw

Leakage from underground fuel tanks has recently become a serious threat to groundwater. Both private and municipal wells have been lost to this type of contamination. Usually, the cause is corrosion of steel tanks that have been in the ground for years.

This problem is particularly acute now because so many tanks installed about 20 years ago are beginning to leak. Several measures can be taken to prevent such leakage. A community may require that in corrosive soils or under certain conditions, old tanks be replaced with new tanks with adequate safeguards. Inventory control is necessary to ensure that tanks remain intact over time.

Underground fuel storage bylaws, while intended to protect groundwater, may be ineffective and, in some cases, create unnecessary expense for owners. MAPC has reviewed a number of underground fuel storage bylaws and the Code of Masachusetts Regulations governing petroleum storage, and has discussed underground fuel storage regulations with the State Fire Marshal's Office and the Massachusetts Petroleum Council. MAPC published a handbook in the spring of 1982 which describes a step-by-step approach for regulating underground tanks.

Hazardous Materials Bylaw

In the past, unless an area was known to be or suspected of being contaminated by hazardous materials, local officials generally have not concerned themselves with identifying potential sources of contamination. Given the increasing concern for groundwater protection and the heightened awareness of the dangers of improper hazardous materials handling and disposal methods, local officials should be aware of those sources in their community currently generating and/or disposing of hazardous wastes.

While general categories of sources may have the potential to generate hazardous wastes, operating and maintenance practices so differ among similar industries that local officials cannot assume that a local industry in a suspect category actually generates hazardous wastes. Even if it does, proper storage and disposal would not necessarily threaten groundwater resources. An inventory of land uses within groundwater resource areas should be conducted by the local hazardous waste coordinator, with assistance from appropriate town departments, to determine which industries have the potential to contaminate groundwater.

Some communities with industries that have a high potential for groundwater contamination, have chosen to adopt a hazardous materials bylaw as their primary means of protecting groundwater. Some of these bylaws also include fuel, obviating a separate bylaw for underground fuel storage.

Road Salting

Contamination of water supplies from road salt has taken its toll on a number of communities in the MAPC region and across the state. According to "Chemical Contamination," a 1979 report published by the Special Legislative Commission on Water Supply, 90 communities in Massachusetts and at least 45 communities in the MAPC region have water supplies with high salt levels.

The state requires that drinking water supplies contain no more than 20 parts per million (ppm) of sodium. If this limit is exceeded, the water supplier is required to report the excess to all customers so that those with salt restricted diets are aware of it and may obtain water elsewhere. If the sodium level continues to increase, the state can require that the water supply be closed.

A detailed discussion of road salting and water supplies, including a model road salting program, is contained in MAPC's Water Resources Protection Techniques manual (1978). In addition, the Massachusetts Department of Environmental Quality Engineering, in cooperation with the Lower Pioneer Valley Regional Planning Commission, has recently published a report on identifying potential salt contamination areas and the best management practices for road salt use.

Board of Health Regulations

Historically, local boards of health in Massachusetts have played an important role in the protection of public health, promotion of sanitary living conditions and protection of the environment. State statutes and regulations require that boards of health perform many duties relating to protection of health through environmental controls. These requirements reflect the legislature's understanding that many health problems are related to environmental conditions and are handled best by local officials familiar with local conditions.

In addition to board of health duties that are required by law, the legislature has enacted over the years numerous statutes which authorize and encourage local boards of health to be responsible for addressing a broad range of health and environmental problems at the local level.

Although boards of health have no authority to regulate water supplies directly, the following secondary mechanisms are specific applications of board of health authority that do result in groundwater protection:

--Groundwater monitoring (Ch. 41, s. 69B),

--Septic-system regulations (Ch. 111, s. 127A),

--Underground fuel and chemical storage regulations (Ch. 111, s.31),

--Landfill and hazardous waste regulations (Ch. 111, s. 150a/b), and

--Any other reasonable regulations to protect water supplies from contamination.

Non-Regulatory Techniques

There are several ways of preserving and protecting groundwater supplies which do not require additional bylaws or regulations. Such non-regulatory techniques should be considered part of any town's groundwater protection program.

Water Conservation

Conservation can decrease consumption by as much as 20%. Conservation programs can include a number of different measures, such as installing water-saving plumbing fixtures, recycling water, repairing leaky pipes, or instituting a progressive rate structure. Many towns in the MAPC region have implemented local conservation programs; among the most successful have been programs in North Reading, Stoughton, and Arlington. The Boston Water and Sewer Commission also has conserved an enormous amount of water through its leak-detection and repair program. Private industries and businesses have been in the forefront of water conservation. Substantial water savings, sometimes more than 25%, can be achieved by some of the larger water users.

Conservation programs produce various benefits for water quality and quantity, including savings for the municipality as well as for industry and the individual homeowner. Less water consumed means less waste water to treat since approximately 85% of residential water consumed is discharged as wastewater. Persons connected to municipal sewer facilities generally pay twice for the water they use -- first for the water itself, and then for the sewer service (sewer use charges are often based on water usage). For hot water, additional energy costs must be figured in. As water is consumed at ever increasing rates, the capital cost of constructing water systems and sewer and treatment facilities must be considered.

The metering of each residence, industry, or business encourages conservation of water in a number of ways. Users become more conscious of the amount of water that they are using and usually use less. Meters allow water distributors and providers of sewer service to charge for water actually used. In places where shortage are acute, users can be charged progressively more for water use beyond a certain point.

Municipal Conservation. At the municipal level, conservation techniques can maximize the utility of existing water supply resources and can delay or avoid the costly work of exploring new ones. The Massachusetts Conservation Service Corp. (an affiliate of the Masachusetts Association of Conservation Commissions) is working with the state Division of Water Pollution Control to generate local demonstration projects to test research based conservation techniques.

Residential water use accounts for approximately one half of the total water consumed by most communities.

Studies at the state and community level have examined a number of relatively simple and inexpensive programs and devices which may save between 5 and 20% of the water used by a community over a long period. For example, 5% savings might be expected by a community using toilet tank inserts, aerated showerheads, and home leak detection and maintenance.

A local public education program should be undertaken to create understanding and support for changes in town regulations, plumbing codes, and state law to create a demand for water saving appliances and devices so that they will be readily available. To be successful in developing a comprehensive and effective reduction in community water consumption and in changing habits and attitudes toward use, a local education program should be highly visible and involve as broad a range of community interest groups as possible. The education program should address the specific needs of the local homeowner, industry, municipal decision makers, and business people.

A central community group should initiate and coordinate the effort of the public education program. In some communities, the local League of Women Voters, Women's Club, Rotary, and selectmen have fulfilled this role with great success. The Jaycees now are committed to a statewide water conservation campaign.

Industrial Conservation. There are sufficient incentives for industry to conserve water; the next step is to make industry aware of these incentives. As previously mentioned, industries discharging into municipal systems usually must pay a sewer charge which may double the bill. If, industry requires a wastewater treatment facility, costs should be directly related to the amount of water treated. For example, programs at Raytheon (Andover, Lowell, and Wayland), Digital Equipment Corporation (Maynard), Western Electric (North Andover), and General Electric (Lynn) include measures to reduce the amount of wastewater that must undergo treatment to meet local, state, and EPA requirements.

Regardless of tax incentives, which may or may not be available, many industries have found that conservation can save substantial amounts of money through simple, low-cost measures. The first step for every industry is a water audit. It is necessary to know where and how water is being used before effective action can be taken to control usage.

A detailed analysis of water conservation, including an economic analysis of demand management programs and water conservation measures, has been completed by the New England River Basins Commission (NERBC). In a series of reports entitled Before the Well Runs Dry, programs on drought management and how to design a local water conservation plan are presented. Since NERBC was terminated, copies of the handbooks are now available from the New England Water Works Association, 850 Rear Providence Highway, Dedham, MA 02026 (327-9656).

Acquisition of Land

One of the most effective means of protecting critical environmental lands from development is outright purchase. Discussion of local regulatory controls is based on the assumption that sensitive environmental areas will remain in private ownership, requiring that the uses to which they are put must be regulated to prevent water quality problems. If these lands are in public ownership, regulatory programs are unnecessary.

Some communities are fortunate to receive large tracts of land as donations to the town or to a Land Conservation Trust. However, most communities must purchase land and/or find ways to fund these land purchases.

Eminent domain is another way to acquire important land . Under MGL Ch. 40, s.41, towns may purchase or take by eminent domain lands within the watershed of any water supply that are necessary to protect that supply, even if the land is in another community.

Conservation Restrictions

If outright purchase or taking of land is not feasible, a community may want to consider negotiating a conservation restriction or transfer of development rights with the property owner.

Conservation restrictions, created under MGL ch. 184, s. 31-33, entitle the property owner to retain ownership, but he/she must agree not to develop the land for a certain period of time--from 5 years to perpetuity. The degree of restrictiveness may vary with the property owner and the community agreeing to a restriction on all development or merely on certain activities.

The property owner benefits from a conservation restriction by receiving a property tax abatement; the community benefits by maintaining an important groundwater recharge area in its natural state. For more information on conservation restrictions, call or write the Masssachusetts Association of Conservation Commissions.

Transfer of Development Rights

Land use regulations typically impose limitations on the expectations of individuals to develop their land as they wish, sometimes directly conflicting with the individual's wish to profit from this property. Despite this, typical regulations make no provision for compensating those whose land is regulated.

Communities that have attempted to restrict the use of certain lands, for example, realize that regulations prohibiting all use of the land are often challenged on the basis that they deprive the owner of his property rights without compensating him for the loss. The technique of transfer of development rights (TDR) attempts to bridge this gap between private property and public regulation. TDR is based on the notion that land ownership consists of a bundle of rights that can be separated and sold individually. The right to develop the property is separated from other rights such as access and agricultural use, and a value is placed on that right.

While there are many variations of how a system of transfer of development rights could operate, a general system can be sketched here to indicate how a program might operate to protect water quality. A comprehensive plan would be drawn up designating areas within the community to be developed as residential and commercial (development zones) and areas to be kept as open space or rural-agricultural fringe lands (restricted areas). Restricted areas would be water-related--wetlands or aquifer-recharge areas that should be regulated to safeguard water quality. Development zones would be areas served by municipal services (sewer and water) and able to support relatively high densities of development without threatening water quality or other environmental degradation.

Central to TDR is the notion that development rights can be transferred from one parcel to another. In this example, the owner of the land in the restricted zone could sell (thereby transferring) his rights to an owner of land in the development zone. Both parties would stand to gain. The owner of the restricted land (wetlands, for example) cannot use his development rights on his own property because of the regulations that have been applied, yet he can profit from the land by selling his rights. He also receives a tax advantage since his land is now at a lower value, reflecting the elimination of the right to develop his property. The owner of the land in the development zone, on the other hand, can develop his property at a certain density under current zoning, yet if he purchases development rights, he is allowed by the town to build at higher densities. It is to his economic advantage to purchase the rights.

A system of development rights transfer would require more administrative expertise than some of the traditional regulatory techniques discussed earlier in this chapter. Because of its complexity a TDR scheme might not be suitable for all communities, but its advantages make it an attractive proposal for certain municipalities. One advantage is that except for initial costs in increased planning studies and determination of the number of rights to be assigned to certain properties, there is no continuing cost to the municipality except for administration. The private market conducts the transactions for compensation to landowners and acquisition of necessary development rights, while the community receives the beneficial effects of relocation of the development. More important from a water quality perspective, this type of system allows a community to protect critical water and land resources while accommodating desired commercial, industrial, and residential growth.

Runoff Control, Treatment and Recharge

Storage

The primary purpose of storing runoff is to reduce the volume and velocity of stormwater to aid flood and erosion control. Reducing and delaying the peak flow of runoff can also mitigate the first flush effect, thereby benefiting water quality as well.

Storage is a well documented cost-effective method for reducing some runoff problems. It is particularly useful in combined sewer systems, which otherwise would overflow with untreated wastewater. Storage is simple in design and operation. It can be located above ground, if land is available, or underground. Extra capacity can easily be added to storage areas.

Parking Lot Ponding

Because there are no structural limits, impervious parking lots have a greater potential for reducing runoff volume and velocity than do rooftops. Lots need not be perfectly level; in fact, the pavement should slope slightly towards a remote area of the parking area so ponding can occur without inconveniencing motorists too frequently. Runoff can flow slowly through small grates into a closed drainage system.

Parking lot ponding is inexpensive because it is easy to design and maintain. Access is conveniently provided for cleaning debris from the depression. The pond is usually accepted by the lot's users as long as it does not block traffic flow and eventually empties.

Where storage depressions are impractical, runoff can be delayed by using a coarse-textured pavement, such as pea stone in binder. The coarse texture will disrupt the momentum of stormwater sheet flow across a smooth lot. Some storage can be achieved within the ripples.

Parking lot ponding also provides an opportunity for oil and hazardous materials spills to be contained on the site. The drain gate could be temporarily replaced by a solid, impervious plate so a spill stays within parking lot confines.

When considering parking lot ponding as a drainage option, it should be recognized that stormwater can become heated to 90^{0} on asphalt on a summer afternoon. Hot runoff can harm fish in streams, particularly sensitive species such as trout.

Retention/Detention Basins

Retention/detention basins slow runoff by holding it and releasing it to downstream areas at a controlled rate . Detention basins are intended to dry up after a storm, while retention basins may remain wet permanently; a natural pond can be called a retention basin if it is used to store runoff.

The space requirements for basins depends on shape and capacity of the design. Most basins are 3 to 10 feet deep. Emergency overflow spillways are provided in case capacity is exceeded.

Both detention and retention basins will accumulate sediment and weeds that need removal. Retention basins may breed mosquitos. Fencing and landscaping may be needed for safety and aesthetics. The advantages of retention basins include their potential use for recreation, such as skating or boating.

Besides reducing the first flush effect, these basins can help water quality in other ways. If the storm flow is held long enough, some unsuspended solids may settle out, though the basin design is crucial to achieve this settling. Oil and grease may rise to the top of the water in the basin, allowing removal by skimming and absorption.

Dry detention basins can be more readily cleaned than wet retention basins. The latter may actually concentrate contaminants as a catch basin does. At the onset of a storm accumulated sediments are stirred up, metals are dissolved, and a poorer quality outflow can result.

The cost of basins varies widely depending on size, land costs, etc. Maintenance costs range between a few hundred to a few thousand dollars per year.

Catch Basin Cleaning

A catch basin is a small settling chamber placed in a storm drain. Catch basins were originally installed when roads were unpaved and runoff carried a large quantities of dirt into drains. The basin retains heavy debris that might otherwise clog the pipes. Ironically, the two million catch basins in the United States are suspected of increasing, not reducing, the amount of contamination in stormwater due to lack of regular maintenance. During a rainstorm, the flow entering the catch basin churns up the old sump wastes and resuspends them. The turbid stormwater can be more contaminated when it exits the basin into the pipe than when it enters the basin from the street.

Because catch basins are often ineffective and most roads are paved today, several studies have recommended replacing catch basins with inlets without sumps. San Francisco has begun such a program and less frequent cleaning has saved the city money. Yet, catch basins continue to be installed elsewhere as common practice.

Catch basins can be cleaned manually or mechanically. They can be dredged with buckets or vacuumed. A large vacuum truck called an educator, is equipped with a jet hose to loosen the sump sediment and vacuum it up into the truck. A vacuum street cleaner can also be used. Cleaning costs range from $6-10 per basin.

Sorbents, however, cannot be installed and then ignored. The pads begin to degrade after several months and constant immersion in stormwater will cause them to become waterlogged. The pads will continue to float while waterlogged, but their absorption of oil is impaired. Eventually, oil will begin to leak out of the sorbent and back into the water.

A regular maintenance program must be established to service the used sorbents. Because sorbent pads are contaminated by oil, they are classified as a hazardous waste in Massachusetts. Some towns are afraid this hazardous waste classification means that they must hire specialized firms, at great cost, to remove and replace sorbents in a trap. Companies must be licensed by the State Department of Environmental Quality Engineeering (DEQE) to handle and transport hazardous wastes.

Recharge/Infiltration

Using stormwater to replenish groundwater supplies by allowing runoff to percolate into the soil is an important factor that should be considered in any drainage design. But infiltration of runoff should not be thought of as a panacea for preventing contamination of surface waters and replenishing aquifers. Only clean stormwater should be employed as recharge.

Aquifers used for drinking water demand cleaner stormwater recharge than aquifers used for other purposes, such as irrigation. Towns solely dependent on groundwater for their water supply should be most interested in infiltration techniques that preserve groundwater quality. Utmost consideration should be given to well recharge areas or cones of influence.

Infiltration has been accepted as a cleansing process for runoff, too. Previously, most infiltration techniques were designed for quick percolation of large volumes of stormwater into the ground. These same techniques can be modified to allow rapid infiltration of clean runoff.

The basic premise for using infiltration methods for drainage is that hydrologic regimes are least disturbed when as much stormwater as possible can be retained on the site where it originates. Not only are underlying aquifers replenished, but less runoff is added downstream, which reduces downstream flooding and erosion. Infiltration techniques can either be employed using open drainage methods or a combination. As a pollution control method, infiltration is more cost-effective than treatment systems.

One problem common to all infiltration methods is clogging. Pores in the soil must remain clear to allow stormwater seepage. Most suspended solids are deposited on the surface and thus are not a groundwater concern. Even the finest-sized solids settle out near the ground surface. Unfortunately, the ground is so effective at removing solids that their accumulation can interfere with the infiltration process. Sediment must be removed periodically to avoid clogged soil pores.

Today most sumps are cleaned only once per year, but twenty-five years ago towns cleaned catch basins about twice each year. This reduction in cleaning frequency may have adverse effects on water quality. Sump cleaning should be conducted more frequently for drains leading to sensitive water areas. An advantage of catch basin cleaning, in addition to its low cost, is that schedules can be established.

Oil Separators

Concentrations of oil and grease in runoff can range from 10 parts per million (ppm) in residential areas to 40 ppm on highways and over 50 ppm in large parking lots. While these average loads seem small, hydrocarbons can be significant runoff contaminants for several reasons. In addition to its inherent toxicity, oil often contains other toxic compounds such as lead and benzene. Oil films also cause aesthetic problems in receiving waters and harm waterfowl. Finally, oil may coat and clog many of the runoff control and treatment devices, impairing their effectiveness, and increasing maintenance requirements.

The newest development in removing oil from runoff is the gravity separator or oil trap. The device is usually used in a catch basin or other underground holding tank connected to a storm sewer. The runoff flows into a basin, oil floats to the top and gravity sinks the heavier water to the bottom. The design of the discharge pipe and the constant liquid level in the basin prevent the oil from draining out.

Sorbents

Sorbent pads were developed to soak up oil spills. They are made of synthetic fibers, such as polyproplene, that are oleophilic or "oil-liking." They absorb oil onto the sponge-like material, and repel water. The pads are used to mop up small spills when the concentration of oil is not great enough to merit pumping by vacuum hoses or other mechanical means. Because they work effectively on small loads of oil, sorbents can be used to remove normal amounts of hydrocarbons in runoff.

Sorbents are most often used in conjunction with oil trap catch basins. The sorbents generally come in flat pads or mats that are one square foot in size, but they can also be in pillow or granular form. Pads are cheaper than pillows, but become saturated more quickly. Both float on the surface where the oil collects and should not clog the outlet of an oil trap. For use in a conventional catch basin (without a trap), the sorbent must be secured, usually by tying it so it cannot plug the outlet pipe. The sorbent material will absorb only oil products--other pollutants must be removed by other means.

Local conservation commissions throughout Massachusetts, including one in Barnstable, are beginning to require oil traps with sorbent pads in their "orders of conditions" which govern construction near wetlands. This practice may soon spread because it is an inexpensive, visible means of combating runoff contamination. Developers often agree to install sorbents because a sorbent pad costs only about one dollar.

Recharge Basins

Recharge basins are simply ground depressions designed to collect runoff and introduce it into the soil. Natural depressions can be used or basins may be excavated. A recharge basin dries out, while a retention basin does not. A detention basin empties by releasing its contents downstream; a recharge basin will dry out through soil infiltration. These 3 types of basins may appear to be similar, but each functions differently.

A recharge basin is usually sited at the end of a drainage system, whether it collects runoff via open swales and ditches, or via pipes. A primary advantage of a basin is its flexibility of design. Many small basins can be scattered throughout a site, or one large basin can serve the entire area.

Several factors will affect a basin's design and effectiveness. Soils beneath the basin must be sufficiently permeable to allow infiltration; otherwise, the recharge basin becomes a pond. Topography is important because steep slopes make basin construction impractical. Finally, even if construction consists of nothing more than minor excavation and grading, costs can be important where land is expensive, particularly in urban areas. During dry weather large recharge basins can be designed for other uses, such as athletic fields. Problems of aquatic weeds and mosquito breeding should not occur because recharge basins are designed to drain quickly.

While recharge basins have proven to be successful in replenishing aquifers, concerns have been voiced regarding their ability to purify stormwater. Most studies to date have analyzed the quality of the stormwater entering the basin and compared it with the groundwater underneath the basin to determine the basin's treatment efficiencies. These studies indicate that recharge basins seem to be valuable for removing most contaminants, except salts, and offer great potential as an effective stormwater disposal alternative.

Chap. 658. AN ACT PROTECTING THE CONNECTICUT RIVER.

Be it enacted, etc., as follows:

Chapter 21 of the General Laws is hereby amended by inserting after section 8A the following sections:-

Section 8B. The following words and phrases, as used in this section and sections eight C and eight D, shall have the following meanings:-

"Commission", the water resources commission.

"Interbasin transfer", any transfer of the surface and groundwaters, including wastewater, of the commonwealth outside a river basin. If a city or town partially situated within a river basin takes waters from that basin, extension of water services to a portion of the same city or town outside the basin shall not be deemed an interbasin transfer of water.

"Insignificant increase", an increase insufficient to invoke the provisions of section eight C and eight D as determined by the commission; provided, however, that in no event shall an increase over one million gallons per day be deemed insignificant.

"River basin", a geographic area within the commonwealth determined by a body of water and its surrounding drainage area as delineated by the commission.

Section 8C. Any increase over the present rate of interbasin transfers of the surface or groundwater of the river basin shall require the approval of the commission, notwithstanding the provisions of any law to the contrary to increase a present interbasin transfer in additional to such other approvals that may be required by law. Said commission shall file a report of its findings, justifications, and decisions in relation to such approval or disapproval, with the clerks of the house of representatives and the senate, and with the state secretary for publication in the Massachusetts register.

Any emergency connections either approved under the provisions of sections forty and forty-one A of chapter forty, or authorized by a law to provide a necessary and adequate water supply shall be exempt from the provisions of this section for a period not to exceed six months of any calendar year, so long as they fulfill the criteria of the division of water supply of the department of environmental quality engineering.

The provisions of this section and section eight D shall not apply to any insignificant increase over the present rate of interbasin transfers of the surface and groundwater of a river basin. The criteria for determining any insignificance shall be established by the commission based upon the impact to the donor basin.

Section 8D. The commission shall promulgate rules and regulations defining and delineating the river basins of the commonwealth, and establish application procedures and criteria upon which the commission shall base its approval or disapproval of any proposed interbasin transfer of waters. Said criteria shall include but not be limited to the following:-

(1) that all reasonable efforts have been made to identify and develop all viable sources in the receiving area of the proposed interbasin transfer,

(2) that all practical measures to conserve water have been taken in the receiving area, including but not limited to the following:

(a) the identification of distribution system sources of lost water, and where cost effective, the implementation of a program of leak detection and repair;

(b) metering of all water users in the receiving area and a program of meter maintenance;

(c) implementation of rate structures which reflect the costs of operation, proper maintenance and water conservation and encourage the same;

(d) public information programs to promote water conservation, including industrial and commercial recycling and reuse; and

(e) contingency plans for limiting use of water during seasonal or drought shortages;

(3) that an environmental review pursuant to section sixty-one and sections sixty-two to sixty-two H, inclusive, of chapter thirty has been complied with for the proposed interbasin transfer,

(4) that a comprehensive forestry management program which balances water yields, wildlife habitat and natural beauty on watershed lands presently serving the receiving area has been implemented,

(5) that reasonable instream flow in the river from which the water is diverted is maintained, said reasonable instream flow shall be determined by the commission in making its determination of applicability of the proposed interbasin transfer of water.

The decision of the commission to approve or deny a proposed interbasin transfer shall be determined after at least two public hearings, one of which shall be held in the proposed donor community and one of which shall be held in the receiving community and which shall take place after compliance with said sections sixty-one and sixty-two to sixty-two H, inclusive, of chapter thirty. All proceedings under sections eight C and eight D shall be subject to the provisions of chapter thirty A.

Approved December 20, 1983.

Massachusetts Groundwater Quality Standards

The new groundwater quality standards (314 CMR 6.00) established a classification system for groundwater based on designated uses, with minimum groundwater quality criteria applicable to each class. The regulations establish three classes of groundwater:

Class I: Fresh groundwaters designated as a source of potable water supply.

Class II: Saline waters

Class III: Fresh or saline waters designated for uses other than as a source of potable water.

All groundwaters in the state will be assigned a classification by June 1, 1985. The deadline for petitioning DWPC to assign Class III status to a particular groundwater resource is January 1, 1985. All ground waters for which no petition is received will be proposed for Class I status by the state.

Groundwater quality criteria apply to each classification category, with the strictest criteria applying to Class I. Permits for groundwater discharges will be issued based on the maintenance of the quality criteria. Discharges which require a permit include all industrial discharges, sanitary discharges greater than 15,000 gallons per day, and surface runoff which is channelled, collected, and discharged to the ground.

Municipalities should consider the following impacts of the new groundwater discharge permit and classification program:

(1) Those municipalities which have sanitary waste discharges over 15,000 gallons per day, storm water discharges from non-exempted drainage systems, or landfill leachate from a non-approved landfill must apply for a discharge permit. If the discharge would not meet Class I water quality standards (314 CMR 6.06), an application must be made to DWPC to classify the receiving groundwater as Class III by January 1, 1985. After that date, the stricter Class I criteria will automatically apply to all groundwater which have not been accepted as Class III, and discharges which would violate Class I water quality standards will be prohibited.

(2) The new regulations will require testing and monitoring (314 CMR 6.08). Sampling and testing of effluent must be conducted in a manner approved by DWPC. Monitoring wells may also be required by DWPC to determine the mobility of pollutants and pollutant attenuation.

(3) The regulations require that no discharge to groundwater will be approved where the alternative of discharging to a sanitary sewer is readily available. Sewered communities with private or industrial groundwater discharges should consider that those discharges may now require a sewer hook-up to comply with the regulations. This could impact local sewage systems by increasing sewage flows and introducing industrial contaminants to the system. In some cases pre-treatment may be necessary or desirable.

APPENDIX D

Potential Advantages and Disadvantages
of Solid Waste Disposal Methods

Alternative	Potential advantages	Potential disadvantages	Conditions which favor alternative
Sanitary landfilling	Simple, easy to manage	Proper sanitary landfill standards must be observed or the operation may degenerate into an open dump	All solid waste systems must have a landfill for unprocessed waste or for the residues resulting from processing facilities
	Initial investment and operating costs are low		
	Can be put into operation in short period of time	Difficult to locate new sites because of citizen opposition	
	Can receive most types of solid wastes, eliminating the necessity for separation of wastes	Leachate may create water pollution	
		Production of methane gas can constitute a fire or explosion hazard	
	May be used reclaim land	Obtaining adequate cover material may be difficult	
Sanitary landfilling of baled solid waste	Extends life of landfill (double that of a fill for unprocessed wastes)	Resource recovery is precluded once bale is formed	Long hauls needed to reach landfill sites
		Leachate may create water pollution	Shortage of landfill sites requires maximum utilization of available land
	Lowers operating costs at the disposal site		
	Reduces hauling costs where distant sites are used		

Alternative	Potential advantages	Potential disadvantages	Conditions which favor alternative
Sanitary landfilling of shredded solid waste	Extends life of landfill	Jamming and bridging of the feeding equipment can reduce throughput of the mill	Cover material is difficult to obtain
	Does not require daily cover under some conditions		Shortage of landfill sites requires maximum utilization of available land
	Waste is more easily placed and compacted	High level of component wear, especially of hammers	
	Vehicles do not become mired in waste in inclement weather	Danger to employees from flying objects, explosions, fires within the mills, and noise	
	Reduces problems with vectors	Leachate may create water pollution	
	Does not support combustion or lead to blowing litter	Maintenance and repair costs are high	
	Shredding at transfer station or at landfills may be first step in implementing a resource recovery system		
Incineration	Extends life of landfill	Large capital investment	Land available for sanitary landfilling is at a premium
	May be more economical than hauling unprocessed waste to distant landfill	High operating cost	Few if any conditions favor conventional incineration
		Large expenditures may be required for air pollution control equipment	
		Conventional incinerators generate large quantities of waste-water which must be treated and disposed of	

Alternative	Potential advantages	Potential disadvantages	Conditions which favor alternative
Materials recovery systems	Less land required for solid waste disposal	Technology for many operations still new, not fully proven	Markets for sufficient quantities of the reclaimed materials are located nearby
	High public acceptance	Requires markets for recovered materials	Land available for sanitary landfilling is at a premium
	Lower disposal costs may result through the sale of recovered materials and reduced land-filling requirements	High initial investment required for some techniques	Heavily populated area to ensure a large steady volume of solid waste to achieve economies of scale
		Materials must meet specifications of purchaser	
Energy recovery systems	Landfill requirements can be reduced	Requires markets for energy produced	Heavily populated area to ensure a large steady volume of solid waste to take advantage of economy of scale
	Finding a site for an energy recovery plant may be easier than finding a site for a landfill or conventional incinerator	Most systems will not accept all types of waste	Availability of a steady customer for generated energy to provide revenue
		Specific needs of the energy market may dictate parameters of the system design	Desire or need for additional low-sulfur fuel source
	Total pollution is reduced when compared to a system that includes incineration for solid waste disposal and burning fossil fuels for energy	Complex process requiring sophisticated management	Land available for sanitary landfilling is at a premium
		Needs relatively long period for planning and construction between approval of funding and full-capacity operation	
	May be more economical than environmentally sound conventional	Technology for many operations still new, not fully proven	

Alternative	Potential advantages	Potential disadvantages	Conditions which favor alternative
	incineration or remote sanitary landfilling		
	High public acceptance		
	As cost of fossil fuel rises, economics become more favorable		

Source: Decision-Makers Guide in Solid Waste Management, U.S. Environmental Protection Agency, 1976

Recycling

There are two approaches to the collection of recyclable materials: a drop-off center or depot for recycling, and a curbside-collection system. The following summary is taken from an MAPC booklet entitled; "Treasure in Your Trash: A Handbook for Local Recycling Programs."

Depot recycling

The majority of recycling programs in the New England area operate through a depot system, a drop-off site for recyclables, usually located at the community landfill area. Depot systems have several advantages. Depots are usually located at landfill sites where personnel are already employed to oversee trash disposal. Since there are no collection costs and minimal staffing needs, this is the cheapest of the two approaches. In addition, several materials can be recycled by the community with little or no effort beyond that expended to recycle one or two materials due to the fixed, one-time costs of establishing the depot.

Depots have disadvantages, however. First is the inconvenience, especially in communities where trash is collected. Residents may have to make a separate trip to the depot to deposit recyclables. Secondly, recyclables must be separated at home and kept separate during the trip to the recycling center. This effort requires more involvement from local residents. For these reasons, less materials tend to be collected in depot systems than in curbside programs.

Curbside collection recycling

Collecting recyclables from the curbside is the easiest way to encourage recycling, since it requires the least effort from participants. To date, a few communities in the greater Boston area collect recyclables from the curb. The lower frequency of this approach is due not only to its higher costs, but also because relatively few communities in the region collect trash or garbage from curbside. Most communities maintain local landfills or transfer stations to which citizens transport their own trash.

As more communities close their landfills, curbside trash collection may increase. Depending on who collects the trash (municipal trucks, private haulers, or a disposal firm), a curbside recycling program may be a logical component of the curbside service, particularly since every ton recycled is one less ton to pay for at the disposal destination.

APPENDIX E

Highway Projects in Metro-West Communities
Dropped from Design/Implementation

Town	Location	Type of Work	Funding	Approx. Date Dropped	Remarks
Ashland	Cordaville Rd.	Drainage	Non-Fed. Aid	6/18/82	
Framingham	1000' W. of West Rd. to W. of Rt. 126	Reconstruction	Consol. Primary	10/20/77	Part of TAMS Rt. 9 Study
Framingham	Concord St., Union Ave. Lexington St., Lincoln St.	Traffic	Urban Systems	11/79	Dropped by Town
Framingham	Main St., Bridge over Sudbury River	Reconstruction	Urban Systems	1/1/78	Substituted by Fountain St. Bridge
Framingham	Rt. 30 Southborough TL to Framingham Center	Reconstruction	Urban Systems	10/29/80	Town would not sign release to take over job
Framingham	Old Conn. Path Bridge over Mass. Turnpike	Bridge Widening	Non-Fed. Aid	2/79	MTA originally to do Design Work, then backed out
Framingham	Central St., Purchase St. to Wickford Rd.	Reconstruction	State Aid	11/20/79	
Framingham	Framingham/Natick Transportation Study		Undefined	9/78	
Framingham	Rt. 9	Drainage Study	Undefined	1/10/84	
Framingham	Rt. 9, W. of Strathmore Rd. to 1000' W. of West Rd.	Reconstruction	Consol. Primary	10/20/77	Part of TAMS Rt. 9 Study
Southborough	Framingham Rd.,Cross St. to Acre Bridge(Rt. 30)	Reconstruction	Urban Sys. Worcester Urb. Area	3/10/83	
Wellesley	Rt. 128, Wellesley to Lexington	Guardrail	Interstate Resurf.	12/30/81	
Wellesley	Kingsbury St., Bridge over Conrail	Bridge Reconstr.	Consol. Primary	3/10/80	
Wellesley	Rt. 128, Rt. 9(Wellesley) to Mass. Turnpike(Weston)	Reconstruction	Consol. Primary	12/16/82	

Highway Projects in Metro-West Communities
Dropped from Design/Implementation

Town	Location	Type of Work	Funding	Approx. Date Dropped	Remarks
Wellesley	Rt. 9, Bridge under Cedar St.	Bridge Reconstr.	Consol. Primary	2/21/79	
Wellesley	Rt. 9, 2 Locations	Traffic	Urban Systems	10/20/77	
Wellesley	Rockland St., Bridge over Conrail	Bridge Reconstr.	Non-Fed. Aid	3/10/80	
Weston	5 Locs. along Rts. 20&30, South Ave. at Wellesley St.	Traffic	Urban Systems	2/2/84	
Weston	Stony Brook Pkg. Facility		Undetermined	4/76	Environmental Problems, lack of Community Support

METRO-WEST
HIGHWAY PROJECTS INCLUDED IN THE 1984-1988
DRAFT TRANSPORTATION IMPROVEMENT PROGRAM (TIP)

INTERSTATE RESURFACING (4R)

WESTON	RT. 128, WESTON, 01	ID: 088900	ANNUAL	2-5
% Design:	40	PE		
Adv. Date:	June 1987	ROW		
Design Resp:	State	CON		10,400
Work Type:	Reconstruction			

Description: Safety upgrading from Rt. 9 to western terminus of Task "A", Peabody; see also Rt. 128, Dedham, 01, Randolph, 01, Wellesley, 01, and Reading, 01; consultant told to stop work about 1974, design contract kept open; design work dropped 3/8/78; $10,400,000 (8/5/77 estimate).

Also Affects: Waltham, Lexington, Burlington

CONSOLIDATED PRIMARY

FRAMINGHAM	RT. 30, FRAMINGHAM, 03	ID: 110951	ANNUAL	2-5
% Design:	70	PE		
Adv. Date:	December 1984	ROW		
Design Resp:	State	CON		1,750
Work Type:	Reconstruction			

Description: Reconstruct Cochituate Rd. (Rt. 30) from Concord St. to Mass. Pike exit #13; Rt. 30 extending easterly to the toll road entrance and Rt. 30 extending westerly of Rt. 9 included; approved by Project Review Committee 8/15/79; $1,400,000 cost estimate.

SUDBURY	RT. 20, SUDBURY, 01	ID: 100800	ANNUAL	2-5
% Design:	25	PE		
Adv. Date:	1986	ROW		
Design Resp:	State	CON		1,500
Work Type:	Traffic			

Description: Rt. 20 (Boston Post Rd.) at Nobscot Rd. and Union Ave. (widening, channelization, signals); includes signals at four locations; traffic data submitted 11/20/75; denied by Project Review Committee 10/14/76; approved by Project Review Committee 3/7/79, 5/23/79; $700,000, $850,000 (District 4 cost estimate 12/76); funding formerly Urban Systems.

URBAN SYSTEMS BOSTON URBANIZED AREA

ASHLAND	ASHLAND, CBD, 01	ID: 002404	ANNUAL	2-5
% Design:	40	PE		
Adv. Date:		ROW		
Design Resp:	Town	CON		2,000
Work Type:	Reconstruction			

Description: Reconstruction of Main St. from Myrtle St. to Rt. 135, Pleasant St. from Main St. to High St., Front St. from Main St. to River Bridge, Homer St. from Main St. to Rt. 135, and Cherry St. from Main St. to Pleasant St.; approved by Project Review Committee 8/15/79; $1,500,000 (PRC meeting 8/15/79).

ASHLAND	ASHLAND, 5 LOCATIONS, 01	ID: 002400	ANNUAL	2-5
% Design:	75	PE		
Adv. Date:	August 1984	ROW		
Design Resp:	Town	CON	850	
Work Type:	Traffic			

Description: Six locations ATP #1, location #1, 2, 3, 4, 7 and 8 - W. Union St., Summer St., Cherry St., Union St., Chestnut St., Homer St./Union St., Fountain St., Main St., Prospect St., Chestnut St./Pond St., Eliot St., Union St., Main St.; $350,000 (highway design 10/79).

FRAMINGHAM	FRAMINGHAM PRKG FACIL, 01	ID: 027000	ANNUAL	2-5
% Design:	0	PE		
Adv. Date:		ROW		
Design Resp:	Town	CON		75
Work Type:	Construction			

Description: Construction of parking facility adjacent to Framingham railroad station; approved by Project Review Committee 5/31/77, town responsible for PE; town action required at 6/15/77 town meeting; town owns one land parcel; approved by Project Review Committee 5/23/79; $75,000 (selectman's letter, 5/11/77).

FRAMINGHAM	RT. 126, FRAMINGHAM, 01	ID: 086450	ANNUAL	2-5
% Design:	40	PE		
Adv. Date:	June 1985	ROW		
Design Resp:	State	CON		1,000
Work Type:	Construction			

Description: Safety improvements Rt. 126 (Concord St.) and Rt. 30 (Cochituate Rd.); approved by Project Review Committee 6/18/81.

FRAMINGHAM	TEMPLE ST., FRAMINGHAM, 01	ID: 133520	ANNUAL	2-5
% Design:	0	PE		
Adv. Date:		ROW		
Design Resp:	Town	CON		60
Work Type:	Reconstruction			

Description: Provision of right turn lane and improvement of sight distance and exit approach; city responsible for design and ROW--inactive 1/83; approved by Project Review Committee 6/6/79; $60,000 (PRC meeting 6/6/79).

NATICK	RT. 135, NATICK, 03	ID: 090101	ANNUAL	2-5
% Design:		PE		
Adv. Date:	November 1984	ROW		
Design Resp:		CON		125
Work Type:				

Description: Traffic signals at Rt. 135 at Rt. 27 and Hartford St. at Mill St.; approved by Project Review Committee 1/6/83.

URBAN SYSTEMS BOSTON URBANIZED AREA (cont'd)

SUDBURY	SUDBURY, 4 LOCATIONS, 01	ID: 132100	ANNUAL	2-5
% Design:	0	PE		
Adv. Date:		ROW		
Design Resp:	Town	CON		174

Work Type: Traffic
Description: Rt. 117 at Haynes Rd., Union Ave. at Concord Rd., Concord Rd. at Pantry Rd., Rt. 20 at Peakham Rd; work includes channelization; town responsible for design; approved by Project Review Committee 3/22/78; $174,000 (PRC 3/22/78).

WAYLAND	RT. 27, WAYLAND, 01	ID: 105120	ANNUAL	2-5
% Design:	25	PE		
Adv. Date:	1987	ROW		
Design Resp:	Town	CON		100

Work Type: Reconstruction
Description: Installation of traffic control system at Main St. (Rt. 27) and at E. and W. Plain Sts.; town to do design; approved by Project Review Committee 7/23/80; $100,000 (PRC meeting 7/23/80).

HIGHWAY BRIDGE REPLACEMENT AND REHABILITATION

FRAMINGHAM	BOSTON RD., FRAMINGHAM, 01	ID: 006850	ANNUAL	2-5
% Design:	0	PE		
Adv. Date:		ROW		
Design Resp:	State	CON		225

Work Type: Bridge Reconstruction
Description: Bridge #F-7-27 over Rt. 9 westbound to railroad (Marlboro overpass) deck replacement.

FRAMINGHAM	FOUNTAIN ST., FRAMING, 01	ID: 026700	ANNUAL	2-5
% Design:	25	PE		
Adv. Date:	December 1984	ROW		
Design Resp:	Town	CON		0

Work Type: Bridge Reconstruction
Description: Bridge F-7-14, Fountain St. over reservoir #2 and Bracket reservoir; town responsible for design; engineering report, completed for town 11/77, recommends new deck, structural steel repairs, widening shoulders; $256,000 (11/77); Project Review Committee (1/78).

SOUTHBOROUGH	RT. 85, SOUTHBOROUGH, 01	ID: 123330	ANNUAL	2-5
% Design:	0	PE		
Adv. Date:	1986	ROW		
Design Resp:	State	CON		1,000

Work Type: Bridge Reconstruction
Description: Replace Bridge #S-20-5 on Rt. 85 (Marlborough Rd.) over Conrail; approvd by Project Review Committee 4/30/82.

FRAMINGHAM	6 LOCATIONS, FRAMINGHAM,01	ID: 026903	ANNUAL	2-5
% Design:	100	PE		
Adv. Date:	October 1983	ROW		
Design Resp:	State	CON	60	
Work Type:	Traffic			

Description: Advance warning signs at six locations (fiber optics) on Rtes. 9, 3, 3A; Rt. 9 eastbound and westbound at Country Club Lane, Rt. 9 eastbound at Massachusetts Turnpike, Rt. 3A eastbound at Burlington Mall Rd., Rt. 3, Winchester, and Rt. 3A, Billerica; district to design; approved by Project Review Committee 9/8/80; $60,000 (PRC meeting 9/8/80).

Also Affects: Burlington, Billerica, Winchester

NATICK	RT. 9, NATICK, 03	ID: 125301	ANNUAL	2-5
% Design:	60	PE		
Adv. Date:	June 1984	ROW		
Design Resp:	State	CON	300	
Work Type:	Guardrail			

Description: Guardrail replacement, Natick, North Main St.--900 feet east of Lexington Rd., Wellesley, Contract B; formerly (Rt. 9, Brookline, 01).

Also Affects: Wellesley

WELLESLEY	RT. 9, WELLESLEY, 02	ID: 124602	ANNUAL	2-5
% Design:	0	PE		
Adv. Date:	April 1984	ROW		
Design Resp:	State	CON	300	
Work Type:	Guardrail			

Description: Guardrail from Lexington Rd. to Francis Rd.; Contract C; formerly (Rt. 9, Brookline, 01).

Highway Projects in MetroWest Communities
Already Advertised for Construction

Town	Location	Type of Work	Funding	Advert. Date
Framingham	California Ave./Rt. 9 Rt. 30/New York Ave. Rt. 30/Valley Rd.	Reconstruction	Cons. Primary	09/80
Framingham	Rt. 9, W. of Speen St. to Rt. 126 (Median Closure)	Construction	Cons. Primary	11/08/80
Framingham	Concord St./Dennison Ave. Waverly St./Fountain St.	Traffic	Urban Systems	03/10/79
Framingham	Danforth St., Bridge	Bridge Recons.	Hwy Bridge Repl	07/24/82
Natick	Rt. 9, 18.50 miles Guardrail	Construction	Cons. Primary	10/27/79
Natick	Rt. 9, Speen Str. Grade Separation & Interchange, E. of Speen Str. to Strathmore Rd.	Bridge Constr.	Cons. Primary	11/26/77
Natick	6 Locs., Rt. 9 N. Main Str., East & West Central Strs.	Traffic	Urban Systems	12/04/76
Natick	Rt. 135 at Speen Str.	Traffic	Urban Systems	05/21/77
Natick	Washington Ave., Bridge over Conrail	Bridge Recons.	Urban Systems	12/16/78
Natick	Union Str., 1500' NW. of Woodland Str. to Eliot Str. (Rt. 16)	Reconstruction	State Aid	10/24/81
Southborough	Rt. 30, Westborough/Southborough TL to Sears Rd.	Resurfacing	Non-Fed. Aid	01/23/82
Sudbury	Concord Rd. at Lincoln Rd. (Grade Approach)	Traffic	Non-Fed. Aid	06/02/78
Sudbury	Landham Rd., 1000' s. of Rt. 20 to Framingham TL	Reconstuction	State Aid	79
Wayland	Rt. 126 at Rt. 27	Traffic	High Hazard	09/11/76

Highway Projects in MetroWest Communities
Already Advertised for Construction

Town	Location	Type of Work	Funding	Advert. Date
Wellesely	Rt. 9, Lexington Rd. to Francis Rd.	Guardrail	Hazard Elimin.	01/11/84
Wellesley	Rt. 128, Wellesley to Wakefield	Resurfacing	Non-Fed. Aid	09/19/80
Wellesley	Rt. 128	Guardrail	Non-Fed. Aid	12/31/82
Wellesley	Rt. 135	Resurfacing	Non-Fed. Aid	02/07/81

APPENDIX F: MODEL SITE-PLAN-REVIEW BYLAW

The zoning bylaw/ordinance is hereby amended by adding the following section:

SECTION: SITE PLAN REVIEW

A. Purpose

The purpose of site plan review is to ensure that the design and layout of certain developments permitted as of right (or by special permit) will constitute suitable development and will not result in a detriment to the neighborhood or the environment.

In considering a site plan the (Special Permit Granting Authority (SPA)) shall assure:

a. Protection of adjacent areas against detrimental or offensive uses on the site by provision of adequate surface water drainage, buffers against light, sight, sound, dust, and vibration, and preservation of light and air;

b. convenience and safety of vehicular and pedestrian movement within the site and in relation to adjacent areas;

c. adequacy of the methods of disposal for wastes;

d. protection of environment features on the site and in adjacent areas;

e. adequate protection to prevent pollution of surface waters and groundwater.

B. Projects Requiring Site Plan Review

No building, other than a (single-family or two-family dwelling or building accessory to such dwelling) shall be erected or externally enlarged by more than 10 percent of gross floor area (or, no business or industrial building shall be erected or externally enlarged, and no business or industrial use shall hereafter be established or expanded in ground area) except in conformity with a site plan bearing an endorsement of approval from the (SPA). The (SPA) shall adopt regulations for carrying out its duties under this section.

C. Procedure

1. An applicant for site plan review under this section shall file with the (SPA)____ copies of each of an application and a site plan. Unless this requirement is waived by the (SPA), the site plan shall be prepared by an engineer, architect, or landscape architect.

2. The site plan shall show all existing and proposed buildings, existing and proposed contour elevations, structures, parking spaces, driveway openings, driveways, service areas, facilities

for sewage, refuse and other waste disposal and for surface-water drainage, wetlands, surface water, areas subject to the 100-year flood, maximum ground-water elevation, location of aquifers, private or public wells and drinking-water supplies in relation to the site, and landscape features such as fences, walls, planting, areas, walks, and lighting, both existing and proposed. The site plan shall also show the relation of the above features to adjacent ways and properties. The site plan shall also show all contiguous land owned by the applicant or by the owner of the property which is the subject of the application.

3. The applicant shall submit such material as may be required regarding measures proposed to prevent pollution of surface or groundwater, soil erosion, increased runoff, and flooding.

4. The applicant shall submit such material as may be required regarding design features intended to integrate the proposed new development into the existing landscape, to enhance aesthetic assets, and to screen objectionable features from neighbors.

5. The applicant shall submit such material as may be required regarding the projected traffic flow patterns into and upon the site for both vehicles and pedestrians and an estimate of the projected number of motor vehicle trips to an from the site for an average day and for peak hours.

6. The (SPA) shall, within five days of receipt, transmit to the planning board, the building inspector and the conservation commission copies of the application and site plan. The boards receiving these copies shall have up to 35 days to make recommendations to the (SPA).

7. The (SPA) shall hold a public hearing within 45 days of receipt of an application and shall take final action within 90 days from the time of hearing, as provided in G.L. ch. 40a, s 9 and 11, (and in section __ of this bylaw/ordinance, relating to special permit procedures. Such final action shall consist of either (1) a finding and determination that the proposed project will constitute a suitable development and will not result in detriment to the neighborhood or the environment or (2) a written denial of the application stating the reasons for such denial. Approval may be made subject to conditions, modifications and restrictions as the (SPA) may deem necessary; and any construction, reconstruction, alteration or addition shall be carried on only in conformity with the application and the site plan.

8. (If the planning board is the special permit authority under this section, it shall, insofar as practical, adopt regulations establishing procedures for submission of a combined plan and application which shall satisfy this section and the board's regulations under the Subdivision Control Act.)

9. Projects reviewed by other town boards are exempt as follows:_____.

D. Criteria for Approval

1. The site plan shall show adequate measures to percent pollution of surface or groundwater soil erosion, increased runoff, changes in groundwater level, and flooding.

2. The development design shall be integrated into the existing landscape to enhance aesthetic assets and to screen objectionable features from neighbors,

3. The site plan shall show adequate measures to prevent traffic congestion and dangerous access within the site and onto existing town ways.

4. The site plan shall protect adjacent areas against detrimental or offensive uses on the site by providing adequate surface-water drainage, buffers against light, sound dust, noise, and vibration.

5. The site plan shall show adequate methods for disposal of wastes.

All site plans complying with this section and which do not tend to impair the health, safety, convenience and welfare of the inhabitants of the town in general shall be approved.

ADDENDUM TO METROWEST DEVELOPMENT DIRECTORY

(Informal Listing)

Ashland

1. Workmen's Circle: 650 residential units; Route 126.

Framingham

1. Westchester Associates: office, 55,400 sq. ft; California Street
2. Cambridge Eye Associates: office 25,000 sq. ft; Herbert and Arlington Streets.
3. Strehlke: office, 57,000 sq. ft; Newberry and Speen Street.
4. Temple Place: 30,600 sq. ft; Temple and Paul Street.
5. Jonathan Maynard: office; 32,900 sq. ft; Vernon and Grove Street.
6. Triton Industries: retail; 22,591 sq. ft; Worcester Road.

Natick

No major additions

Southborough

1. Flatley Co: office Park, 8 or 9 office buildings on 103 acre's; Route 9 and Route 495.
2. Unnamed: residential 100 units off Sears Road.

Sudbury

1. Raytheon addition: office, 130,000 sq. ft; Route 20.
2. Patti/Orr development: retail space; Route 20
3. Motel: 32 units with restaurant; Route 20 at Longfellow.

Wayland

No major additions

Wellesley

1. Wellesley College: $14 million new major sports center.

Weston

1. Hines Co: office park; 680,000 sq. ft; Routes 20 and 128.

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